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PURSUANT TO
PROTECTIVE ORDER

EXHIBIT A

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INFRINGEMENT OF U.S. 7,620,327 BY FUJITSU

Fujitsu Network Communications (“Fujitsu”) infringed one or more claims of U.S. 7,620,327 by selling and offering for sale the Fujitsu 100G OIF 168pin Coherent Transceiver (FIM85200), 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100), 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100), 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102), 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402), 100G QSFP28 Transceiver (FIM37700; FIM37800), 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA), 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721), HD62 OTN Switch Aggregator Unit, TM61 OTU4 OTN Transponder Demarcation Unit, and Flashwave 7420 WDM Platform products, as well as the compatible chassis in which they are installed, and other products operating in a substantially similar manner such as, for example, the Flashwave 9500 Platform product and all compatible components and chassis, and the IFinity Platform product and all compatible components and chassis. (the “Accused Instrumentalities”).

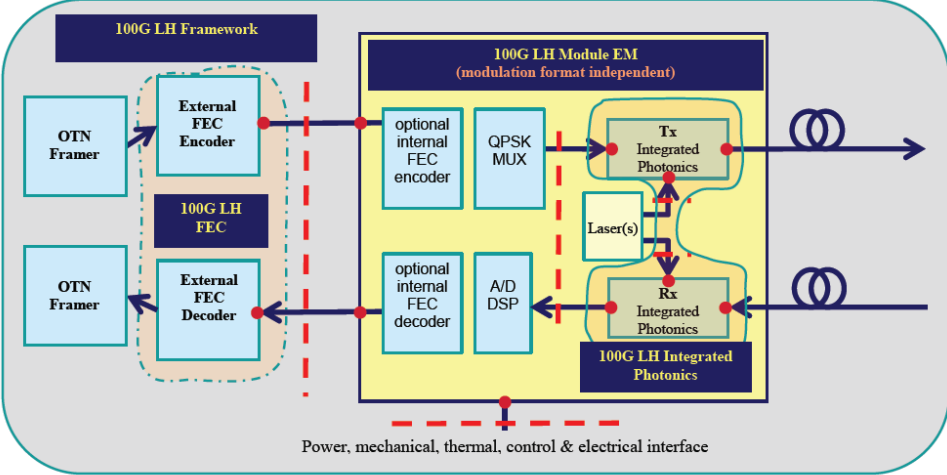
Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
1 ¹	[pre] A transceiver card for a telecommunications box for transmitting data over a first optical fiber and receiving data over a second optical fiber, the card comprising:	<p>Fujitsu infringed Claim 1, and the claims discussed herein that directly or indirectly depend on Claim 1, by making, selling, using, offering for sale, and/or causing to be used the Accused Instrumentalities.</p> <p>To the extent that the preamble is considered to be a limitation, the Accused Instrumentalities comprise transceiver card for a telecommunications box for transmitting data over a first optical fiber and receiving data over a second optical fiber.</p> <p>For example: the Fujitsu 1100G OIF 168pin Coherent Transceiver (FIM85200) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html);</p>

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¹ Claim 1 is no longer asserted, but several claims dependent on Claim 1 remain at issue.

Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP DCO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp-dco/);</p> <p>the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/);</p> <p>the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/);</p> <p>the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/);</p> <p>the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/);</p> <p>the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721) is a component of a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet);</p> <p>the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); and</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<p>the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 8-9 (“All the blocks illustrated are contained on a single printed circuit board. The large block on the right represents the 100G transceiver module – electro mechanicals. As discussed above this OIF project addresses physical aspects of this module and the electrical data and control interfaces to it.”).</p>  <p style="text-align: center;">Figure 7. Block diagram of a transceiver module</p>

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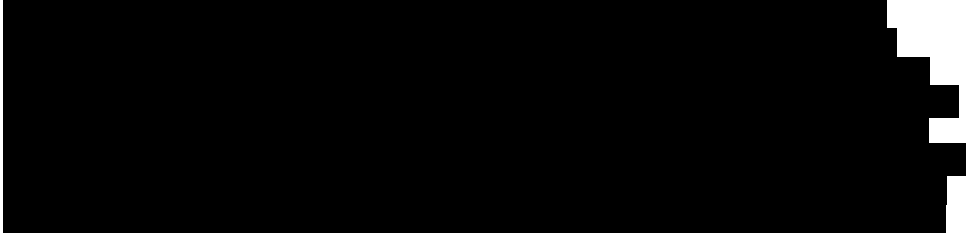

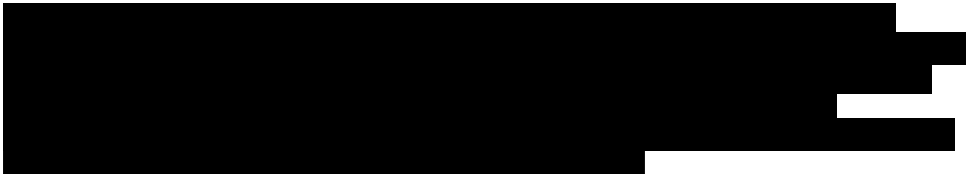
Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement																																																																																							
		<p>By way of example and without any limitation, Fujitsu is a member of the OIF 100G standard. See, e.g., OIF-DPC-MRX-01.0-IA at 32.</p> <p>12 Appendix C: List of companies belonging to the OIF at approval date</p> <table border="1"> <tr><td>Acacia Communications</td><td>Fujikura</td><td>NeoPhotonics</td></tr> <tr><td>ADVA Optical Networking</td><td>Fujitsu</td><td>NTT Corporation</td></tr> <tr><td>Alcatel-Lucent</td><td>Furukawa Electric Japan</td><td>Oclaro</td></tr> <tr><td>Altera</td><td>Google</td><td>Orange</td></tr> <tr><td>AMCC</td><td>Hewlett Packard</td><td>PacketPhotonics</td></tr> <tr><td>Amphenol Corp.</td><td>Hitachi</td><td>PETRA</td></tr> <tr><td>Analog Devices</td><td>Huawei Technologies</td><td>Picomatrix</td></tr> <tr><td>Anritsu</td><td>IBM Corporation</td><td>PMC Sierra</td></tr> <tr><td>Applied Communication Sciences</td><td>Infinera</td><td>QLogic Corporation</td></tr> <tr><td>Avago Technologies Inc.</td><td>Inphi</td><td>Qorvo</td></tr> <tr><td>Broadcom</td><td>Intel</td><td>Ranovus</td></tr> <tr><td>Brocade</td><td>Ixia</td><td>Rockley Photonics</td></tr> <tr><td>BRPhotonics</td><td>JDSU</td><td>Samtec Inc.</td></tr> <tr><td>BTI Systems</td><td>Juniper Networks</td><td>Semtech</td></tr> <tr><td>China Telecom</td><td>Kaiaam</td><td>Spirent Communications</td></tr> <tr><td>Ciena Corporation</td><td>Kandou</td><td>Sumitomo Electric Industries</td></tr> <tr><td>Cisco Systems</td><td>KDDI R&D Laboratories</td><td>Sumitomo Osaka Cement</td></tr> <tr><td>ClariPhy Communications</td><td>Keysight Technologies, Inc.</td><td>TE Connectivity</td></tr> <tr><td>Coriant R&G GmbH</td><td>LeCroy</td><td>Tektronix</td></tr> <tr><td>CPqD</td><td>Luxtera</td><td>TELUS Communications, Inc.</td></tr> <tr><td>Deutsche Telekom</td><td>M/A-COM Technology Solutions</td><td>TeraXion</td></tr> <tr><td>Dove Networking Solutions</td><td>Mellanox Technologies</td><td>Texas Instruments</td></tr> <tr><td>EMC Corp</td><td>Microsemi Inc.</td><td>Time Warner Cable</td></tr> <tr><td>Emcore</td><td>Microsoft Corporation</td><td>US Conec</td></tr> <tr><td>Ericsson</td><td>Mitsubishi Electric Corporation</td><td>Verizon</td></tr> <tr><td>ETRI</td><td>Molex</td><td>Xilinx</td></tr> <tr><td>FCI USA LLC</td><td>MoSys, Inc.</td><td>Yamaichi Electronics Ltd.</td></tr> <tr><td>Fiberhome Technologies Group</td><td>MultiPhy Ltd</td><td>ZTE Corporation</td></tr> <tr><td>Finisar Corporation</td><td>NEC</td><td></td></tr> </table>	Acacia Communications	Fujikura	NeoPhotonics	ADVA Optical Networking	Fujitsu	NTT Corporation	Alcatel-Lucent	Furukawa Electric Japan	Oclaro	Altera	Google	Orange	AMCC	Hewlett Packard	PacketPhotonics	Amphenol Corp.	Hitachi	PETRA	Analog Devices	Huawei Technologies	Picomatrix	Anritsu	IBM Corporation	PMC Sierra	Applied Communication Sciences	Infinera	QLogic Corporation	Avago Technologies Inc.	Inphi	Qorvo	Broadcom	Intel	Ranovus	Brocade	Ixia	Rockley Photonics	BRPhotonics	JDSU	Samtec Inc.	BTI Systems	Juniper Networks	Semtech	China Telecom	Kaiaam	Spirent Communications	Ciena Corporation	Kandou	Sumitomo Electric Industries	Cisco Systems	KDDI R&D Laboratories	Sumitomo Osaka Cement	ClariPhy Communications	Keysight Technologies, Inc.	TE Connectivity	Coriant R&G GmbH	LeCroy	Tektronix	CPqD	Luxtera	TELUS Communications, Inc.	Deutsche Telekom	M/A-COM Technology Solutions	TeraXion	Dove Networking Solutions	Mellanox Technologies	Texas Instruments	EMC Corp	Microsemi Inc.	Time Warner Cable	Emcore	Microsoft Corporation	US Conec	Ericsson	Mitsubishi Electric Corporation	Verizon	ETRI	Molex	Xilinx	FCI USA LLC	MoSys, Inc.	Yamaichi Electronics Ltd.	Fiberhome Technologies Group	MultiPhy Ltd	ZTE Corporation	Finisar Corporation	NEC	
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12 Appendix C: List of companies belonging to the OIF at approval date

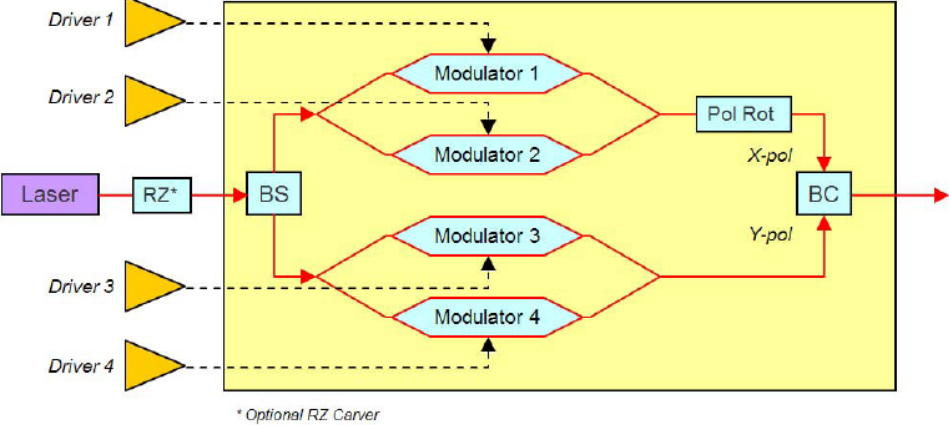
Acacia Communications	Fujikura
ADVA Optical Networking	Fujitsu
Alcatel-Lucent	Furukawa Electric Japan
Altera	Google
AMCC	Hewlett Packard
Amphenol Corp.	Hitachi
Analog Devices	Huawei Technologies
Anritsu	IBM Corporation
Applied Communication Sciences	Infinera
Avago Technologies Inc.	Inphi
Broadcom	Intel
Brocade	Ixia
BRPhotonics	JDSU
BTI Systems	Juniper Networks
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Dove Networking Solutions	Mellanox Technologies
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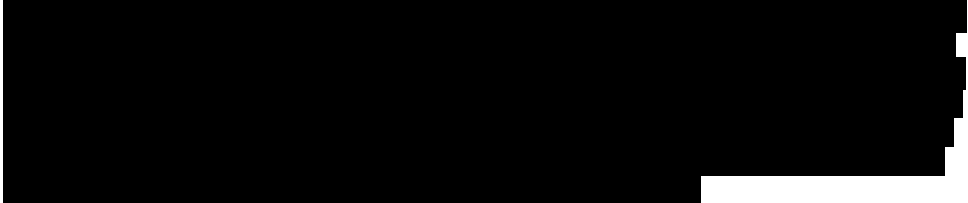
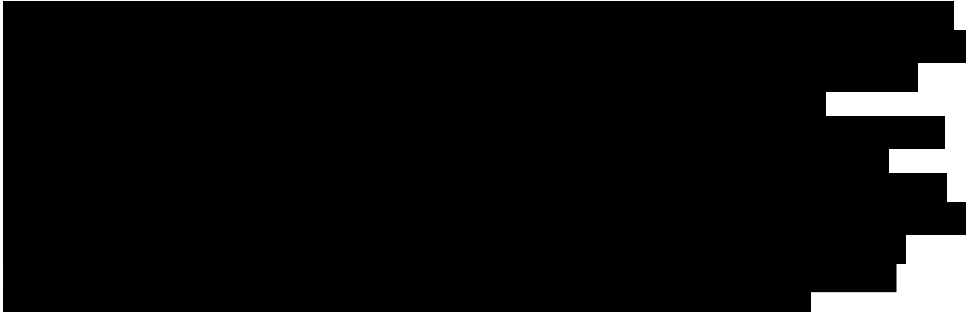
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		  
	[a] a transmitter for transmitting data over the first optical fiber, the transmitter having a laser, a modulator, and a controller receiving input data	<p>The Accused Instrumentalities include a transmitter for transmitting data over the first optical fiber, the transmitter having a laser, a modulator, and a controller receiving input data and controlling the modulator as a function of the input data, the transmitter transmitting optical signals for telecommunication as a function of the input data.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transmitter module which includes a laser, modulators that modulate phase of the light, drivers, including</p>

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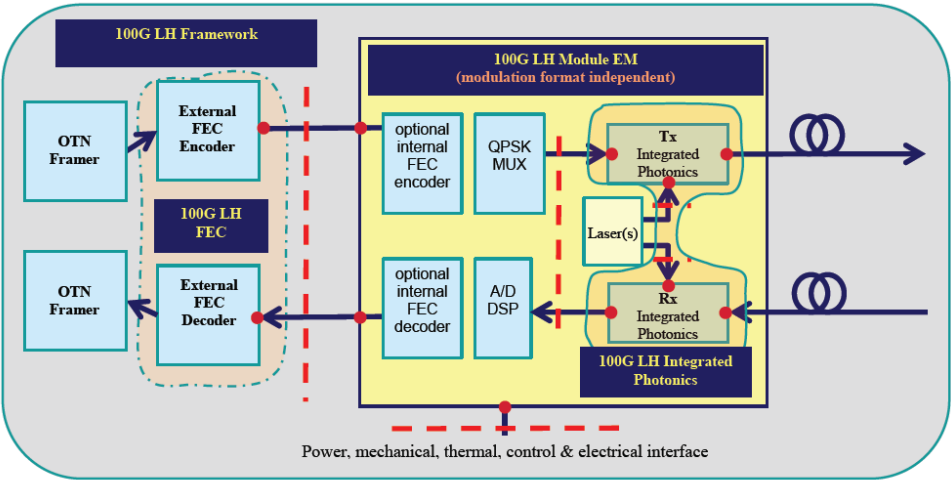
Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
	and controlling the modulator as a function of the input data, the transmitter transmitting optical signals for telecommunication as a function of the input data;	<p>other components that are not represented, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 5-6.</p>  <p style="text-align: center;">* Optional RZ Carver</p> <p style="text-align: center;">Figure 4. Block diagram of a DP QPSK transmitter module</p> <p>By way of example and without any limitation, the OIF 100G standard taught that the “signal [framed incoming data] then passes to the transceiver module. Data is converted to drive signals to control the optical modulators. A transmit laser provides the light source for the modulators. On the receive side the incoming signal is mixed with a local oscillator, demodulated into components, detected, amplified, digitized, then passed into the DSP module.” OIF-FD-100G-DWDM-01.0 at 9.</p>

Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		 
	[b] a fiber output optically connected to the laser for connecting the first optical fiber to the card;	<p>The Accused Instrumentalities include a fiber output optically connected to the laser for connecting the first optical fiber to the card. By way of example and without any limitation, the Accused Instrumentalities include optical fiber interfaces (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html); 100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/; 100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/; 100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/;</p>

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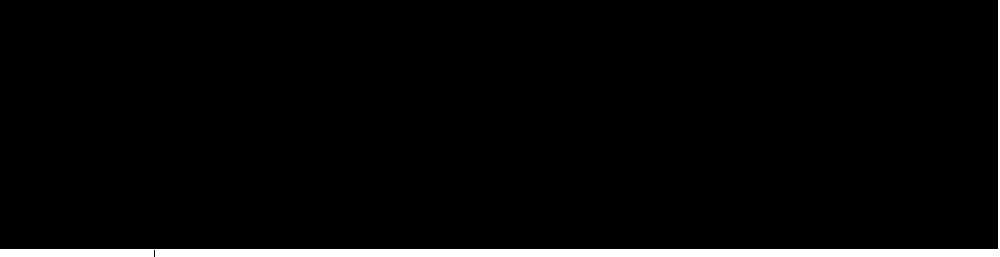
Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/; 100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g); 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g; Flashwave CDS Data Sheet; Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module in which the optical signal is transmitted by Tx through a fiber output, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 9.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>The diagram illustrates the architecture of a transceiver module. It is divided into two main sections: the 100G LH Framework and the 100G LH Module EM (modulation format independent). The Framework section includes an OTN Framer connected to an External FEC Encoder and an External FEC Decoder, which are linked by a 100G LH FEC block. The Module EM section contains an optional internal FEC encoder, a QPSK MUX, an optional internal FEC decoder, and an A/D DSP. These are connected to 100G LH Integrated Photonics, which includes Tx Integrated Photonics, Laser(s), and Rx Integrated Photonics. The module has external optical ports for transmission and reception. A dashed red line at the bottom indicates the Power, mechanical, thermal, control & electrical interface.</p></div> <p>Figure 7. Block diagram of a transceiver module</p> <p>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products</p> <div></div> <div></div>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>	Deleted: Accused Instrumentality
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		
	[c] a fiber input for connecting the second optical fiber to the card;	<p>The Accused Instrumentalities include a fiber input for connecting the second optical fiber to the card. By way of example and without any limitation, the Accused Instrumentalities include an optical fiber interface (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html); 100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/; 100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/; 100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/; 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/; 100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g); 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g; Flashwave CDS Data Sheet; Flashwave 7420 Data Sheet)</p>

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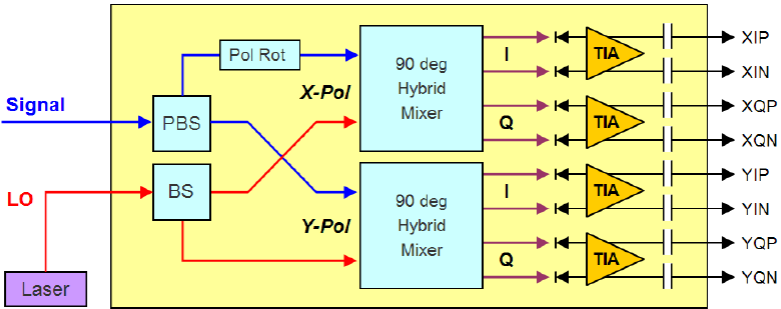
Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module in which the optical signal is received by Rx through a fiber input, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 9.</p> <p>The diagram illustrates a transceiver module architecture. It is divided into two main sections: the '100G LH Framework' and the '100G LH Module EM (modulation format independent)'. The Framework section includes an 'External FEC Encoder' and an 'External FEC Decoder', both connected to 'OTN Framers'. The Module EM section contains an 'optional internal FEC encoder', a 'QPSK MUX', an 'optional internal FEC decoder', and an 'A/D DSP'. The Module EM is connected to 'Tx Integrated Photonics' and 'Rx Integrated Photonics', which are in turn connected to 'Laser(s)'. The entire module is connected to a 'Power, mechanical, thermal, control & electrical interface' at the bottom. The diagram also shows a '100G LH Integrated Photonics' block at the bottom right.</p> <p>Figure 7. Block diagram of a transceiver module</p> <p>[REDACTED]</p>

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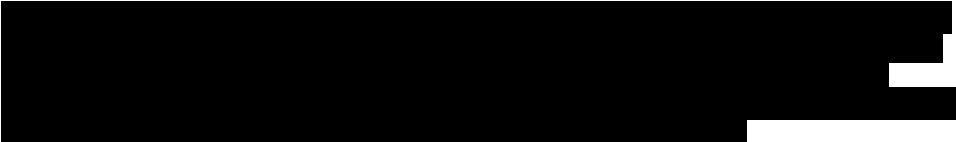
Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
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	[d] a receiver optically connected to the fiber input for receiving data from the second optical fiber; and	<p>The Accused Instrumentalities include a receiver optically connected to the fiber input for receiving data from the second optical fiber.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a receiver module which receives a phase modulated signal through an optical fiber, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p><div></div><div></div></div>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		
	[e] an energy level detector optically connected between the receiver and the fiber input to measure an energy level of the optical signals, wherein the energy level detector includes a plurality of thresholds.	<p>The Accused Instrumentalities include an energy level detector optically connected between the receiver and the fiber input to measure an energy level of the optical signals, wherein the energy level detector includes a plurality of thresholds.</p> <p>By way of example and without any limitation, the OIF 100G standard taught that:</p> <p>[a]s indicated in Figure 2-1, the coherent receiver requires the following basic functionality:</p> <ol style="list-style-type: none"> 1. Eight (8) photo-detectors, comprised of 4 sets of balanced detectors 2. Four (4) linear amplifiers with differential ADC coupled outputs 3. Two (2) ninety degree hybrid mixers with differential outputs 4. A polarization splitting element, separating the input signal into two orthogonal polarizations, with each polarization delivered to a hybrid mixer 5. A polarization maintaining power splitter or polarization splitting element, splitting the local oscillator power equally to the two hybrid mixers. 6. An optical power tap, and monitor photodiode in the signal input path before the signal polarization splitting element. 7. A variable optical attenuator in the signal input path before the signal polarization splitting element. <p>Additional required functionality for the integrated coherent receiver includes:</p> <ul style="list-style-type: none"> • Automatic Gain Control (AGC) and/or Manual Gain Control (MGC) • User settable output voltage swing • Independent output swing adjustment for each of the four outputs

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<p>• Peak indicators for each output (Figure 2-1 is presented below, showing the relationship of the functionalities in addition to the presence of ADC and DSP). OIF-DPC-MRX-01.0-IA at 10-11.</p> <p>Figure 2-1: Functional diagram of a dual polarization micro intradyne coherent receiver.</p> <p>Notes:</p> <ol style="list-style-type: none">1. One configuration for the order of the VOA and MPD is shown. The configuration with the MPD followed by the VOA is an equally acceptable configuration.2. The yellow area enclosed by the dashed line indicates the functionality specified in this implementation agreement. <div></div>

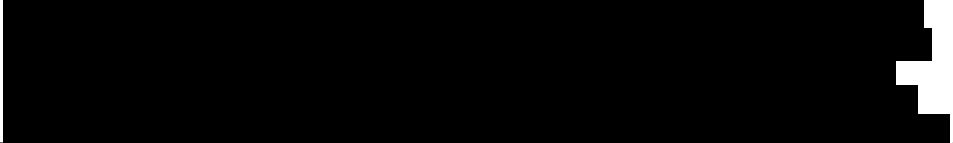
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
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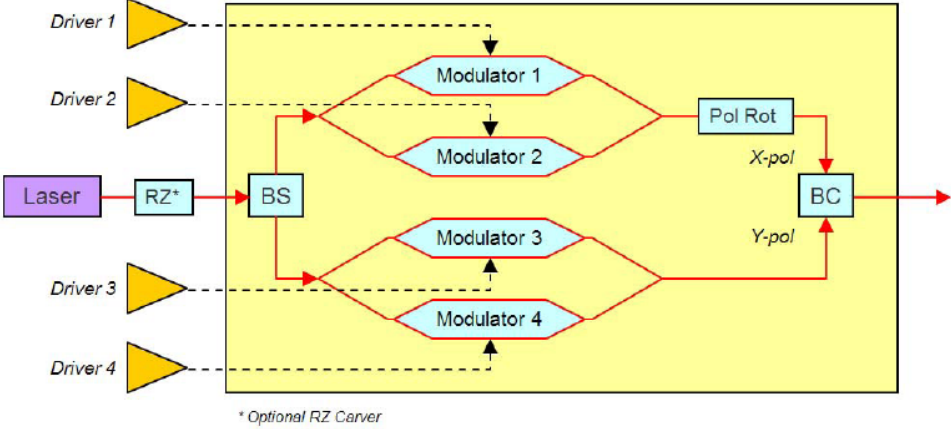
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		
3	The card as recited in claim 1 wherein the modulator is a phase modulator.	<p>The Accused Instrumentalities include a modulator that is a phase modulator. QPSK requires phase modulation. For example:</p> <p>the Fujitsu 100G OTN Muxponder is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html);</p> <p>the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP DCO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp-dco/);</p> <p>the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/);</p> <p>the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/);</p> <p>the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/);</p> <p>the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/);</p> <p>the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G Optical</p>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g); the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721) is a component of a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g); the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); and the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard stated a DP QPSK transmitter module which includes a laser, modulators that modulate phase of the light, drivers, including other components that are not represented, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 5-6.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>* Optional RZ Carver</p><p>Figure 4. Block diagram of a DP QPSK transmitter module</p><p>By way of example and without any limitation, Fujitsu's Flashwave 9500 Series product</p><div style="background-color: black; width: 456px; height: 195px;"></div></div>

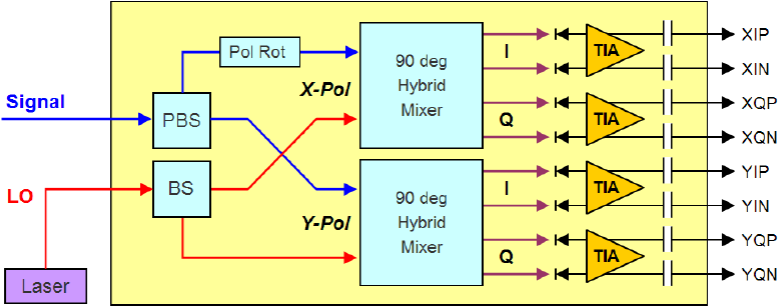
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
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4	The card as recited in claim 3 wherein the receiver receives phase-modulated signals.	<p>The Accused Instrumentalities include a receiver that receives phase-modulated signals. For example:</p> <p>the Fujitsu 1100G OIF 168pin Coherent Transceiver (FIM85200) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html);</p> <p>the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP DCO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp-dco/);</p> <p>the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/);</p> <p>the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/);</p> <p>the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP2</p>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/); the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/); the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g); the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721) is a component of a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g); the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); and the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught that the “signal [framed incoming data] then passes to the transceiver module. Data is converted to drive signals to control the optical modulators. A transmit laser provides the light source for the modulators. On the receive side the incoming signal is mixed with a local oscillator, demodulated into components, detected, amplified, digitized, then passed into the DSP module.” OIF-FD-100G-DWDM-01.0 at 9.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a receiver module which receives a phase modulated signal through an optical fiber, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

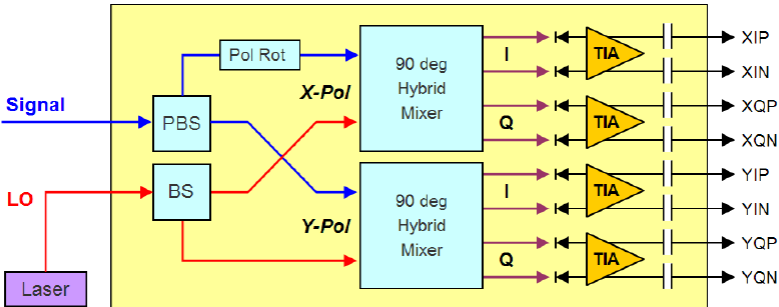
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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p> <div></div> <div></div>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<div></div> <div></div>
5	The card as recited in claim 1 wherein the energy level detector includes a photodiode and a liner or logarithmic amplifier scaling an output of the photodiode.	<p>On information and belief, the Accused Instrumentalities have an energy level detector that includes a photodiode and a linear or logarithmic amplifier scaling an output of the photodiode.</p> <p>By way of example and without any limitation, the OIF 100G standard stated that DP QPSK receiver module contains optical detectors and amplifiers, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p> <hr/> <p>By way of example and without any limitation, an OIF 100G standard taught that As indicated in Figure 2-1, the coherent receiver requires the following basic functionality:</p> <ol style="list-style-type: none">1. Eight (8) photo-detectors, comprised of 4 sets of balanced detectors2. Four (4) linear amplifiers with differential ADC coupled outputs3. Two (2) ninety degree hybrid mixers with differential outputs4. A polarization splitting element, separating the input signal into two orthogonal polarizations, with each polarization delivered to a hybrid mixer5. A polarization maintaining power splitter or polarization splitting element, splitting the local oscillator power equally to the two hybrid mixers.6. An optical power tap, and monitor photodiode in the signal input path before the signal polarization splitting element.

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>7. A variable optical attenuator in the signal input path before the signal polarization splitting element.</p> <p>Additional required functionality for the integrated coherent receiver includes:</p> <ul style="list-style-type: none">• Automatic Gain Control (AGC) and/or Manual Gain Control (MGC)• User settable output voltage swing• Independent output swing adjustment for each of the four outputs• Peak indicators for each output <p>(Figure 2-1 is presented below, showing the relationship of the functionalities in addition to the presence of ADC and DSP). OIF-DPC-MRX-01.0-IA at 10-11.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>Figure 2-1: Functional diagram of a dual polarization micro intradyne coherent receiver.</p><p>Notes:</p><ol style="list-style-type: none">1. One configuration for the order of the VOA and MPD is shown. The configuration with the MPD followed by the VOA is an equally acceptable configuration.2. The yellow area enclosed by the dashed line indicates the functionality specified in this implementation agreement.<div></div></div>
10	The card as recited in claim 1 wherein the plurality of thresholds indicate a	<p>On information and belief, the Accused Instrumentalities include thresholds indicate a drop in amplitude of a phase-modulated signal.</p> <p>By way of example and without any limitation, an OIF 100G standard taught that devices should</p>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
	claim 1 wherein the plurality of thresholds indicate an increase in an optical energy level.	<p>in an optical energy level.</p> <p>By way of example and without any limitation, an OIF 100G standard taught that devices should have “Alarm/Warning Threshold Registers,” including including registers for an Rx power high warning and high alarm. (OIF-CFP2-ACO-01.0, at 81)</p> <p><u>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series product and IFinity products include the card as recited in claim 1 wherein the plurality of thresholds indicate an increase in an optical energy level. See, e.g., Exemplary Evidence of Infringement of Claim 10.</u></p>
14	[pre] A transceiver card for a telecommunications box for transmitting data over a first optical fiber and receiving data over a second optical fiber, the card comprising:	<p>Fujitsu infringed Claim 14, and the claims discussed herein that directly or indirectly depend on Claim 14, by making, selling, using, offering for sale, and/or causing to be used the Accused Instrumentalities.</p> <p>To the extent that the preamble is considered to be a limitation, the Accused Instrumentalities comprise transceiver card for a telecommunications box for transmitting data over a first optical fiber and receiving data over a second optical fiber.</p> <p>For example:</p> <p>the Fujitsu 1100G OIF 168pin Coherent Transceiver (FIM85200) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html);</p> <p>the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP DCO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp-dco/);</p> <p>the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/);</p>

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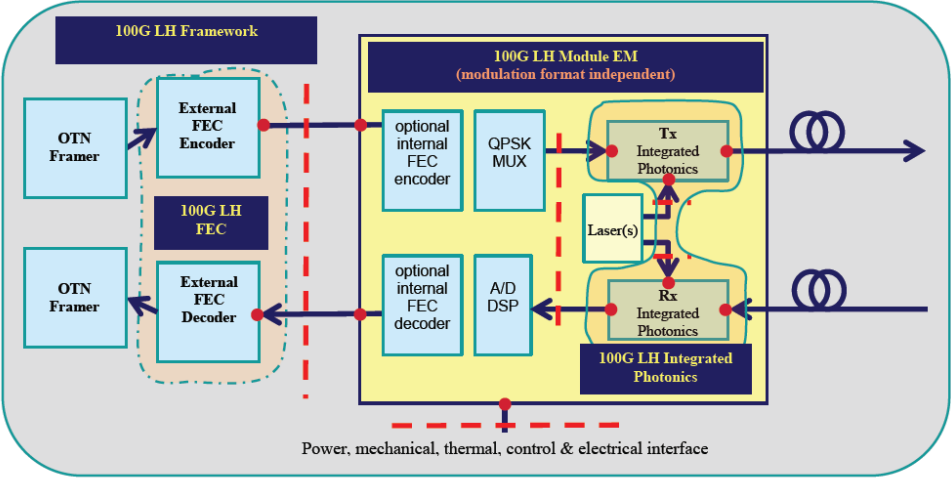
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/);</p> <p>the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/);</p> <p>the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/);</p> <p>the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721) is a component of a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet);</p> <p>the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); and</p> <p>the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 8-9 (“All the blocks illustrated are contained on a single printed circuit board. The large block on the right represents the 100G transceiver module – electro mechanicals. As discussed above this OIF project addresses physical aspects of this module and the electrical data and control interfaces to it.”).</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>Figure 7. Block diagram of a transceiver module</p><p>By way of example and without any limitation, Fujitsu is a member of the OIF 100G standard. See, e.g., OIF-DPC-MRX-01.0-IA at 32.</p></div>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement																																																																																							
		<p>12 Appendix C: List of companies belonging to the OIF at approval date</p> <table> <tr><td>Acacia Communications</td><td>Fujikura</td><td>NeoPhotonics</td></tr> <tr><td>ADVA Optical Networking</td><td>Fujitsu</td><td>NTT Corporation</td></tr> <tr><td>Alcatel-Lucent</td><td>Furukawa Electric Japan</td><td>Oclaro</td></tr> <tr><td>Altera</td><td>Google</td><td>Orange</td></tr> <tr><td>AMCC</td><td>Hewlett Packard</td><td>PacketPhotonics</td></tr> <tr><td>Amphenol Corp.</td><td>Hitachi</td><td>PETRA</td></tr> <tr><td>Analog Devices</td><td>Huawei Technologies</td><td>Picometrix</td></tr> <tr><td>Anritsu</td><td>IBM Corporation</td><td>PMC Sierra</td></tr> <tr><td>Applied Communication Sciences</td><td>Infinera</td><td>QLogic Corporation</td></tr> <tr><td>Avago Technologies Inc.</td><td>Inphi</td><td>Qorvo</td></tr> <tr><td>Broadcom</td><td>Intel</td><td>Ranovus</td></tr> <tr><td>Brocade</td><td>Ixia</td><td>Rockley Photonics</td></tr> <tr><td>BRPhotonics</td><td>JDSU</td><td>Samtec Inc.</td></tr> <tr><td>BTI Systems</td><td>Juniper Networks</td><td>Semtech</td></tr> <tr><td>China Telecom</td><td>Kaiaam</td><td>Spirent Communications</td></tr> <tr><td>Ciena Corporation</td><td>Kandou</td><td>Sumitomo Electric Industries</td></tr> <tr><td>Cisco Systems</td><td>KDDI R&D Laboratories</td><td>Sumitomo Osaka Cement</td></tr> <tr><td>ClariPhy Communications</td><td>Keysight Technologies, Inc.</td><td>TE Connectivity</td></tr> <tr><td>Coriant R&G GmbH</td><td>LeCroy</td><td>Tektronix</td></tr> <tr><td>CPqD</td><td>Luxtera</td><td>TELUS Communications, Inc.</td></tr> <tr><td>Deutsche Telekom</td><td>M/A-COM Technology Solutions</td><td>TeraXion</td></tr> <tr><td>Dove Networking Solutions</td><td>Mellanox Technologies</td><td>Texas Instruments</td></tr> <tr><td>EMC Corp</td><td>Microsemi Inc.</td><td>Time Warner Cable</td></tr> <tr><td>Emcore</td><td>Microsoft Corporation</td><td>US Conec</td></tr> <tr><td>Ericsson</td><td>Mitsubishi Electric Corporation</td><td>Verizon</td></tr> <tr><td>ETRI</td><td>Molex</td><td>Xilinx</td></tr> <tr><td>FCI USA LLC</td><td>MoSys, Inc.</td><td>Yamaichi Electronics Ltd.</td></tr> <tr><td>Fiberhome Technologies Group</td><td>MultiPhy Ltd</td><td>ZTE Corporation</td></tr> <tr><td>Finisar Corporation</td><td>NEC</td><td></td></tr> </table>	Acacia Communications	Fujikura	NeoPhotonics	ADVA Optical Networking	Fujitsu	NTT Corporation	Alcatel-Lucent	Furukawa Electric Japan	Oclaro	Altera	Google	Orange	AMCC	Hewlett Packard	PacketPhotonics	Amphenol Corp.	Hitachi	PETRA	Analog Devices	Huawei Technologies	Picometrix	Anritsu	IBM Corporation	PMC Sierra	Applied Communication Sciences	Infinera	QLogic Corporation	Avago Technologies Inc.	Inphi	Qorvo	Broadcom	Intel	Ranovus	Brocade	Ixia	Rockley Photonics	BRPhotonics	JDSU	Samtec Inc.	BTI Systems	Juniper Networks	Semtech	China Telecom	Kaiaam	Spirent Communications	Ciena Corporation	Kandou	Sumitomo Electric Industries	Cisco Systems	KDDI R&D Laboratories	Sumitomo Osaka Cement	ClariPhy Communications	Keysight Technologies, Inc.	TE Connectivity	Coriant R&G GmbH	LeCroy	Tektronix	CPqD	Luxtera	TELUS Communications, Inc.	Deutsche Telekom	M/A-COM Technology Solutions	TeraXion	Dove Networking Solutions	Mellanox Technologies	Texas Instruments	EMC Corp	Microsemi Inc.	Time Warner Cable	Emcore	Microsoft Corporation	US Conec	Ericsson	Mitsubishi Electric Corporation	Verizon	ETRI	Molex	Xilinx	FCI USA LLC	MoSys, Inc.	Yamaichi Electronics Ltd.	Fiberhome Technologies Group	MultiPhy Ltd	ZTE Corporation	Finisar Corporation	NEC	
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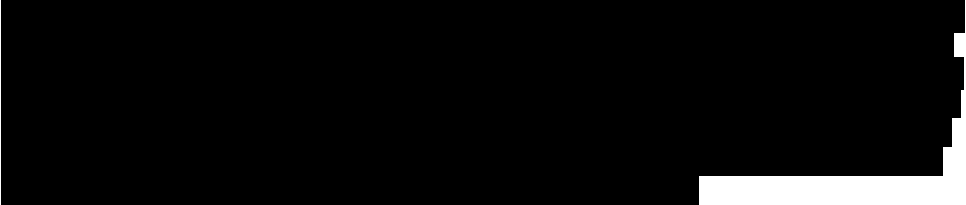
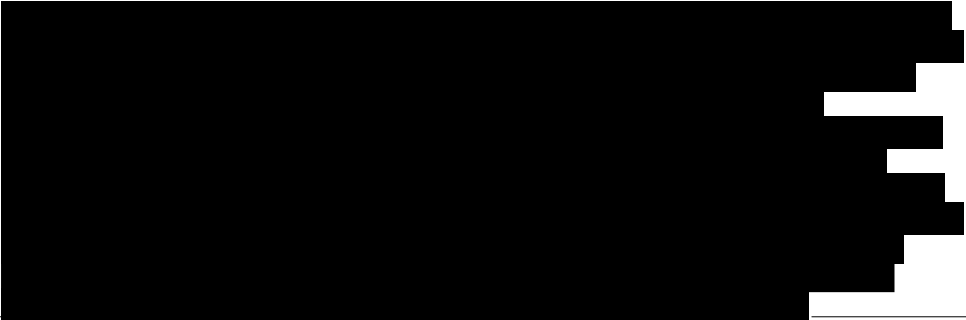
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<div>[REDACTED]</div> <div>[REDACTED]</div> <div>[REDACTED]</div>
	[a] a transmitter for transmitting data over the first optical fiber, the transmitter having a laser, a modulator and a controller receiving input data	<p>The Accused Instrumentalities include a transmitter for transmitting data over the first optical fiber, the transmitter having a laser, a modulator, and a controller receiving input data and controlling the modulator as a function of the input data, the transmitter transmitting optical signals for telecommunication as a function of the input data.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transmitter module which includes a laser, modulators that modulate phase of the light, drivers, including</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
	and controlling the modulator as a function of the input data, the transmitter transmitting optical signals for telecommunication as a function of the input data;	<p>other components that are not represented, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 5-6.</p> <p>Figure 4. Block diagram of a DP QPSK transmitter module</p> <p>By way of example and without any limitation, the OIF 100G standard taught that the “signal [framed incoming data] then passes to the transceiver module. Data is converted to drive signals to control the optical modulators. A transmit laser provides the light source for the modulators. On the receive side the incoming signal is mixed with a local oscillator, demodulated into components, detected, amplified, digitized, then passed into the DSP module.” OIF-FD-100G-DWDM-01.0 at 9.</p> <div></div>

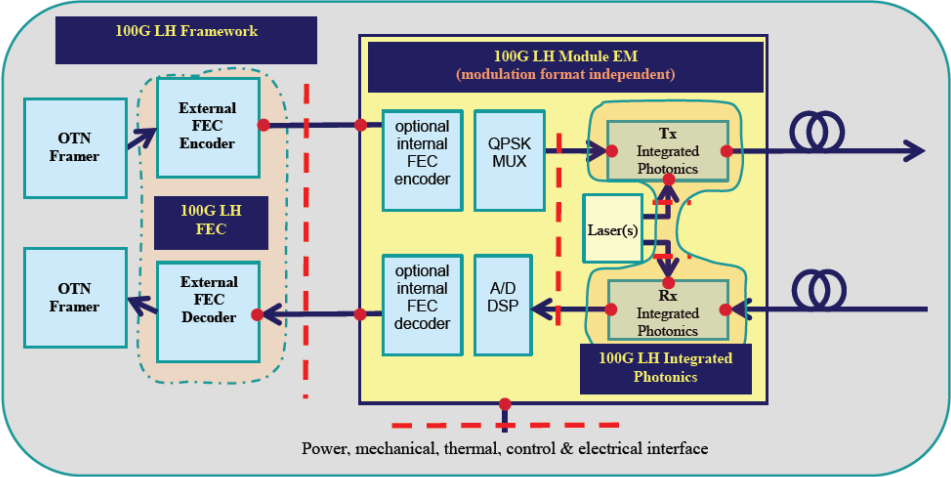
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		 
	[b] a fiber output optically connected to the laser for connecting the first optical fiber to the card;	The Accused Instrumentalities include a fiber output optically connected to the laser for connecting the first optical fiber to the card. By way of example and without any limitation, the Accused Instrumentalities include an optical fiber interface. (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html); 100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/ ; 100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/ ; 100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/ ;

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/; 100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g); 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g; Flashwave CDS Data Sheet; Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module in which the optical signal is transmitted by Tx through a fiber output, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 9.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>The diagram illustrates a transceiver module architecture. It is divided into two main sections: the 100G LH Framework and the 100G LH Module EM (modulation format independent). The Framework section includes OTN Framers connected to External FEC Encoder and External FEC Decoder blocks, which are linked by a 100G LH FEC block. The Module EM section contains optional internal FEC encoder and optional internal FEC decoder blocks, a QPSK MUX, and an A/D DSP. These are connected to 100G LH Integrated Photonics, which includes Tx Integrated Photonics and Rx Integrated Photonics blocks, with Laser(s) in between. The entire module is connected to external networks via fiber optic cables. A dashed red line at the bottom indicates the Power, mechanical, thermal, control & electrical interface.</p></div> <p>Figure 7. Block diagram of a transceiver module</p> <div></div>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<div>Deleted: Accused Instrumentality</div> <div>[Redacted Content]</div>

Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<div style="background-color: black; height: 37px; width: 454px;"></div> <div style="background-color: black; height: 148px; width: 402px;"></div>
	[c] a fiber input for connecting the second optical fiber to the card;	<p>The Accused Instrumentalities include a fiber input for connecting the second optical fiber to the card. By way of example and without any limitation, the Accused Instrumentalities include an optical fiber interface (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html); 100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/; 100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/; 100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/; 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/; 100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g; 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g; Flashwave CDS Data Sheet; Flashwave 7420 Data Sheet)</p>

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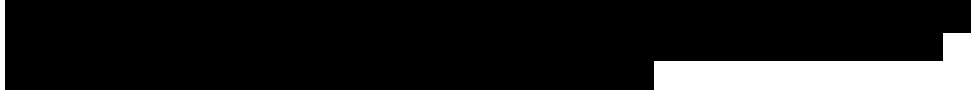
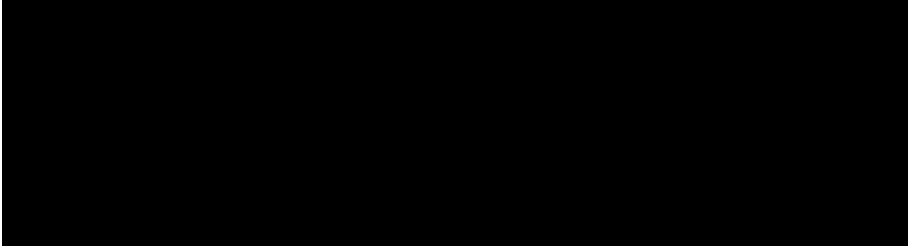
Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module in which the optical signal is received by Rx through a fiber input, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 9.</p> <p>Figure 7. Block diagram of a transceiver module</p> <p>[Redacted text block]</p>

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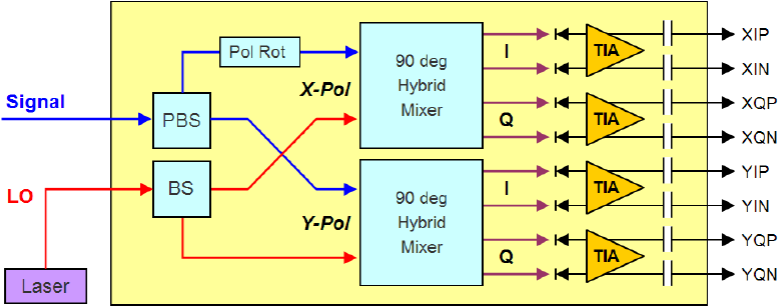
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<div>Deleted: Accused Instrumentality</div> <div></div>

Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		 
	[d] a receiver optically connected to the fiber input for receiving data from the second optical fiber; and	<p>The Accused Instrumentalities include a receiver optically connected to the fiber input for receiving data from the second optical fiber.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a receiver module which receives a phase modulated signal through an optical fiber, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p><div></div><div></div></div>

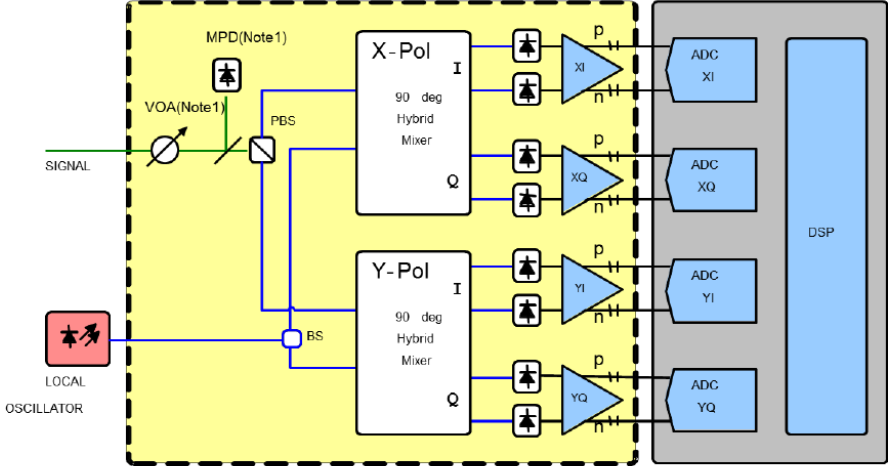
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
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	[e] an energy level detector optically connected between the receiver and the fiber input input to measure an energy level of the optical signals, the energy level detector including a threshold indicating a drop in amplitude of a phase-modulated signal.	<p>The Accused Instrumentalities include an energy level detector optically connected between the receiver and the fiber input to measure an energy level of the optical signals, and the energy level detector includes a threshold indicating a drop in amplitude of a phase-modulated signal. By way of example and without any limitation, an OIF 100G standard taught that devices should have “Alarm/Warning Threshold Registers,” including including registers for an Rx power low warning and low alarm. (OIF-CFP2-ACO-01.0, at 81)</p> <p>By way of example and without any limitation, the OIF 100G standard taught that:</p> <p>[a]s indicated in Figure 2-1, the coherent receiver requires the following basic functionality:</p> <ol style="list-style-type: none"> 1. Eight (8) photo-detectors, comprised of 4 sets of balanced detectors 2. Four (4) linear amplifiers with differential ADC coupled outputs 3. Two (2) ninety degree hybrid mixers with differential outputs 4. A polarization splitting element, separating the input signal into two orthogonal polarizations, with each polarization delivered to a hybrid mixer 5. A polarization maintaining power splitter or polarization splitting element, splitting the local oscillator power equally to the two hybrid mixers. 6. An optical power tap, and monitor photodiode in the signal input path before the signal polarization splitting element.

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>7. A variable optical attenuator in the signal input path before the signal polarization splitting element.</p> <p>Additional required functionality for the integrated coherent receiver includes:</p> <ul style="list-style-type: none">• Automatic Gain Control (AGC) and/or Manual Gain Control (MGC)• User settable output voltage swing• Independent output swing adjustment for each of the four outputs• Peak indicators for each output <p>(Figure 2-1 is presented below, showing the relationship of the functionalities in addition to the presence of ADC and DSP). OIF-DPC-MRX-01.0-IA at 10-11.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>Figure 2-1: Functional diagram of a dual polarization micro intradyne coherent receiver.</p><p>Notes:</p><ol style="list-style-type: none">1. One configuration for the order of the VOA and MPD is shown. The configuration with the MPD followed by the VOA is an equally acceptable configuration.2. The yellow area enclosed by the dashed line indicates the functionality specified in this implementation agreement.</div>

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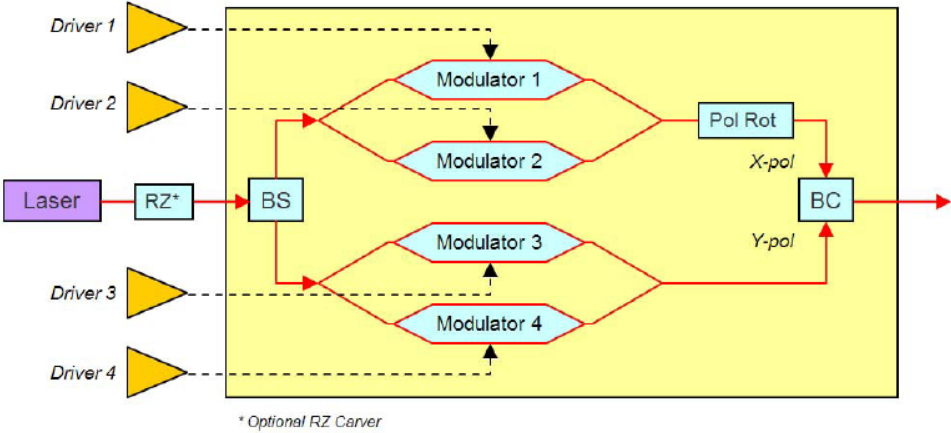
Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>	Deleted: Accused Instrumentality
		<div>[REDACTED]</div>	

Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<div>[REDACTED]</div> <div>[REDACTED]</div> <div>[REDACTED]</div>
16	The card as recited in claim 14 wherein the modulator is a phase modulator.	The Accused Instrumentalities include a modulator that is a phase modulator. QPSK requires phase modulation. For example: the Fujitsu 1100G OIF 168pin Coherent Transceiver (FIM85200) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html);

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP DCO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp-dco/);</p> <p>the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/);</p> <p>the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/);</p> <p>the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/);</p> <p>the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/);</p> <p>the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721) is a component of a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet);</p> <p>the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); and</p>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard stated a DP QPSK transmitter module which includes a laser, modulators that modulate phase of the light, drivers, including other components that are not represented, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 5-6.</p>  <p>Figure 4. Block diagram of a DP QPSK transmitter module</p> <p><u>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products and IFinity products comprise a card as recited in claim 14 wherein the modulator is a phase modulator. See, e.g., Exemplary Evidence of Infringement of Claim 3.</u></p>
17	The card as recited in claim 14 wherein the receiver receives	The Accused Instrumentalities include a receiver that receives phase-modulated signals. For example:

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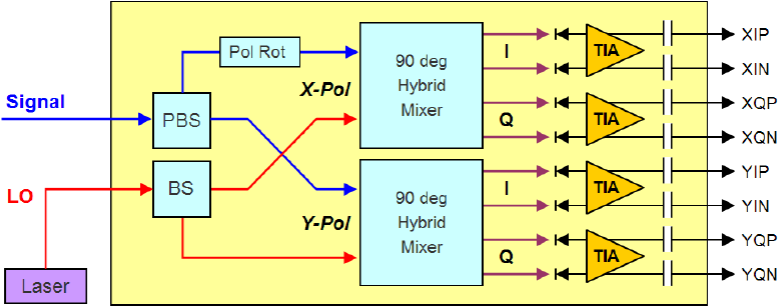
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
	phase-modulated signals.	<p>the Fujitsu 1100G OIF 168pin Coherent Transceiver (FIM85200) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html);</p> <p>the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP DCO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp-dco/);</p> <p>the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/);</p> <p>the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/);</p> <p>the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/);</p> <p>the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/);</p> <p>the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721) is a component of a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p>

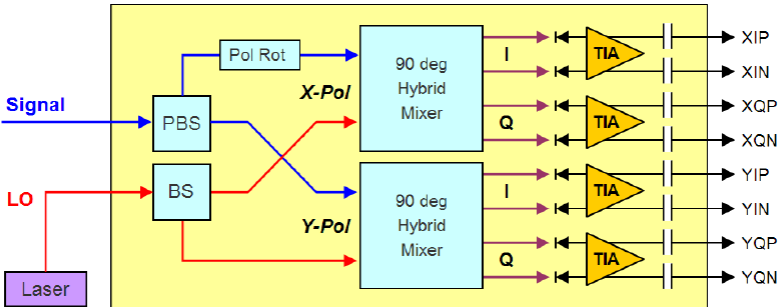
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); and the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught that the “signal [framed incoming data] then passes to the transceiver module. Data is converted to drive signals to control the optical modulators. A transmit laser provides the light source for the modulators. On the receive side the incoming signal is mixed with a local oscillator, demodulated into components, detected, amplified, digitized, then passed into the DSP module.” OIF-FD-100G-DWDM-01.0 at 9.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a receiver module which receives a phase modulated signal through an optical fiber, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p> <p><u>By way of example and without any limitation, Fujitsu's Flashwave 9500 Series products and IFinity products comprise a card as recited in claim 14 wherein the receiver receives phase-modulated signals. See, e.g., Exemplary Evidence of Infringement of Claim 4.</u></p>
18	The card as recited in claim 14 wherein the energy level detector includes a photodiode and a liner or logarithmic amplifier scaling an output of the photodiode.	<p>On information and belief, the Accused Instrumentalities have an energy level detector that includes a photodiode and a linear or logarithmic amplifier scaling an output of the photodiode.</p> <p>By way of example and without any limitation, the OIF 100G standard stated that DP QPSK receiver module contains optical detectors and amplifiers, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

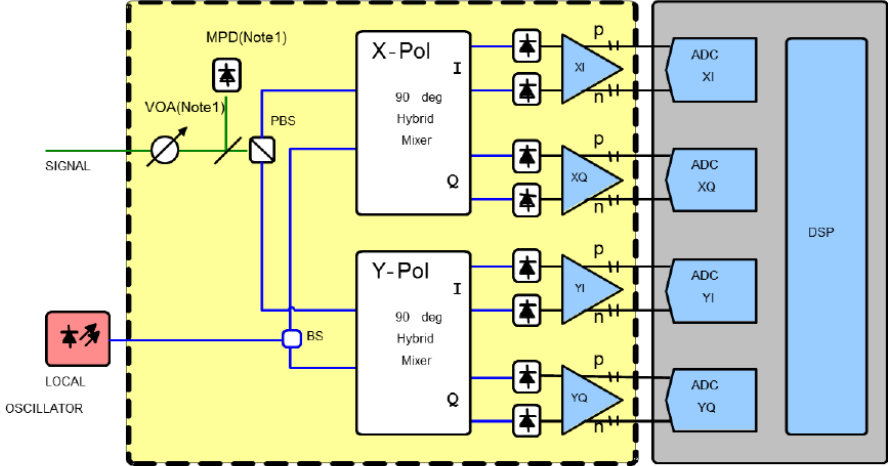
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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p> <p>By way of example and without any limitation, an OIF 100G standard taught that As indicated in Figure 2-1, the coherent receiver requires the following basic functionality:</p> <ol style="list-style-type: none">1. Eight (8) photo-detectors, comprised of 4 sets of balanced detectors2. Four (4) linear amplifiers with differential ADC coupled outputs3. Two (2) ninety degree hybrid mixers with differential outputs4. A polarization splitting element, separating the input signal into two orthogonal polarizations, with each polarization delivered to a hybrid mixer5. A polarization maintaining power splitter or polarization splitting element, splitting the local oscillator power equally to the two hybrid mixers.6. An optical power tap, and monitor photodiode in the signal input path before the signal polarization splitting element.

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>7. A variable optical attenuator in the signal input path before the signal polarization splitting element.</p> <p>Additional required functionality for the integrated coherent receiver includes:</p> <ul style="list-style-type: none">• Automatic Gain Control (AGC) and/or Manual Gain Control (MGC)• User settable output voltage swing• Independent output swing adjustment for each of the four outputs• Peak indicators for each output <p>(Figure 2-1 is presented below, showing the relationship of the functionalities in addition to the presence of ADC and DSP). OIF-DPC-MRX-01.0-IA at 10-11.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 2-1: Functional diagram of a dual polarization micro intradyne coherent receiver.</p> <p>Notes:</p> <ol style="list-style-type: none">1. One configuration for the order of the VOA and MPD is shown. The configuration with the MPD followed by the VOA is an equally acceptable configuration.2. The yellow area enclosed by the dashed line indicates the functionality specified in this implementation agreement. <p><u>By way of example and without any limitation, Fujitsu's Flashwave 9500 Series products and IFinity products comprise a card as recited in claim 14 wherein the energy level detector includes a photodiode and a linear or logarithmic amplifier scaling an output of the photodiode. See, e.g., Exemplary Evidence of Infringement of Claim 5.</u></p>
22	The card as recited in claim 14 wherein the plurality of	On information and belief, the Accused Instrumentalities include threshold settings that bound an acceptable energy range for the received light.

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
	thresholds bound an acceptable energy range for the received light.	<p>By way of example and without any limitation, an OIF 100G standard taught that devices should have “Alarm/Warning Threshold Registers,” including an “RX Power Monitor Alarm/Warning Threshold Select.” (OIF-CFP2-ACO-01.0, at 81) The threshold settings bound an acceptable energy range for the received light in order to provide a meaningful indication of when the power is out of an acceptable range.</p> <p><u>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products and IFinity products comprise a card as recited in claim 14 wherein the plurality of thresholds bound an acceptable energy range for the received light. See, e.g., Exemplary Evidence of Infringement of Claim 9.</u></p>
25	[pre] A transceiver card for a telecommunications box for transmitting data over a first optical fiber and receiving data over a second optical fiber, the card comprising:	<p>Fujitsu infringed Claim 25, and the claims discussed herein that directly or indirectly depend on Claim 25, by making, selling, using, offering for sale, and/or causing to be used the Accused Instrumentalities.</p> <p>To the extent that the preamble is considered to be a limitation, the Accused Instrumentalities comprise transceiver card for a telecommunications box for transmitting data over a first optical fiber and receiving data over a second optical fiber.</p> <p>For example: the Fujitsu 1100G OIF 168pin Coherent Transceiver (FIM85200) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html); the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP DCO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp-dco/); the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/);</p>

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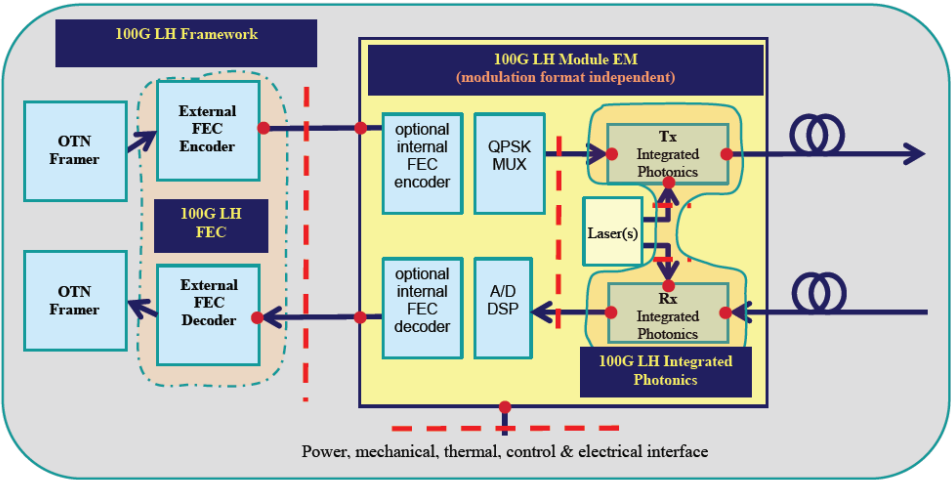
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By way of example and without any limitation,

Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/);</p> <p>the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/);</p> <p>the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/);</p> <p>the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721) is a component of a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet);</p> <p>the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); and</p> <p>the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 8-9 (“All the blocks illustrated are contained on a single printed circuit board. The large block on the right represents the 100G transceiver module – electro mechanicals. As discussed above this OIF project addresses physical aspects of this module and the electrical data and control interfaces to it.”).</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>The diagram illustrates a transceiver module architecture. It is divided into two main sections: the 100G LH Framework and the 100G LH Module EM (modulation format independent). The Framework section includes OTN Framers, External FEC Encoders, and External FEC Decoders. The Module EM section includes optional internal FEC encoders and decoders, a QPSK MUX, A/D DSP, and Tx/Rx Integrated Photonics. A central Laser(s) block is connected to the Tx and Rx photonics. The entire module is connected to external interfaces via power, mechanical, thermal, control, and electrical connections.</p></div> <p>Figure 7. Block diagram of a transceiver module</p> <p>By way of example and without any limitation, Fujitsu is a member of the OIF 100G standard. See, e.g., OIF-DPC-MRX-01.0-IA at 32.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement																																																																																							
		<p>12 Appendix C: List of companies belonging to the OIF at approval date</p> <table> <tr><td>Acacia Communications</td><td>Fujikura</td><td>NeoPhotonics</td></tr> <tr><td>ADVA Optical Networking</td><td>Fujitsu</td><td>NTT Corporation</td></tr> <tr><td>Alcatel-Lucent</td><td>Furukawa Electric Japan</td><td>Oclaro</td></tr> <tr><td>Altera</td><td>Google</td><td>Orange</td></tr> <tr><td>AMCC</td><td>Hewlett Packard</td><td>PacketPhotonics</td></tr> <tr><td>Amphenol Corp.</td><td>Hitachi</td><td>PETRA</td></tr> <tr><td>Analog Devices</td><td>Huawei Technologies</td><td>Picomatrix</td></tr> <tr><td>Anritsu</td><td>IBM Corporation</td><td>PMC Sierra</td></tr> <tr><td>Applied Communication Sciences</td><td>Infinera</td><td>QLogic Corporation</td></tr> <tr><td>Avago Technologies Inc.</td><td>Inphi</td><td>Qorvo</td></tr> <tr><td>Broadcom</td><td>Intel</td><td>Ranovus</td></tr> <tr><td>Brocade</td><td>Ixia</td><td>Rockley Photonics</td></tr> <tr><td>BRPhotonics</td><td>JDSU</td><td>Samtec Inc.</td></tr> <tr><td>BTI Systems</td><td>Juniper Networks</td><td>Semtech</td></tr> <tr><td>China Telecom</td><td>Kaiaam</td><td>Spirent Communications</td></tr> <tr><td>Ciena Corporation</td><td>Kandou</td><td>Sumitomo Electric Industries</td></tr> <tr><td>Cisco Systems</td><td>KDDI R&D Laboratories</td><td>Sumitomo Osaka Cement</td></tr> <tr><td>ClariPhy Communications</td><td>Keysight Technologies, Inc.</td><td>TE Connectivity</td></tr> <tr><td>Coriant R&G GmbH</td><td>LeCroy</td><td>Tektronix</td></tr> <tr><td>CPqD</td><td>Luxtera</td><td>TELUS Communications, Inc.</td></tr> <tr><td>Deutsche Telekom</td><td>M/A-COM Technology Solutions</td><td>TeraXion</td></tr> <tr><td>Dove Networking Solutions</td><td>Mellanox Technologies</td><td>Texas Instruments</td></tr> <tr><td>EMC Corp</td><td>Microsemi Inc.</td><td>Time Warner Cable</td></tr> <tr><td>Emcore</td><td>Microsoft Corporation</td><td>US Conec</td></tr> <tr><td>Ericsson</td><td>Mitsubishi Electric Corporation</td><td>Verizon</td></tr> <tr><td>ETRI</td><td>Molex</td><td>Xilinx</td></tr> <tr><td>FCI USA LLC</td><td>MoSys, Inc.</td><td>Yamaichi Electronics Ltd.</td></tr> <tr><td>Fiberhome Technologies Group</td><td>MultiPhy Ltd</td><td>ZTE Corporation</td></tr> <tr><td>Finisar Corporation</td><td>NEC</td><td></td></tr> </table>	Acacia Communications	Fujikura	NeoPhotonics	ADVA Optical Networking	Fujitsu	NTT Corporation	Alcatel-Lucent	Furukawa Electric Japan	Oclaro	Altera	Google	Orange	AMCC	Hewlett Packard	PacketPhotonics	Amphenol Corp.	Hitachi	PETRA	Analog Devices	Huawei Technologies	Picomatrix	Anritsu	IBM Corporation	PMC Sierra	Applied Communication Sciences	Infinera	QLogic Corporation	Avago Technologies Inc.	Inphi	Qorvo	Broadcom	Intel	Ranovus	Brocade	Ixia	Rockley Photonics	BRPhotonics	JDSU	Samtec Inc.	BTI Systems	Juniper Networks	Semtech	China Telecom	Kaiaam	Spirent Communications	Ciena Corporation	Kandou	Sumitomo Electric Industries	Cisco Systems	KDDI R&D Laboratories	Sumitomo Osaka Cement	ClariPhy Communications	Keysight Technologies, Inc.	TE Connectivity	Coriant R&G GmbH	LeCroy	Tektronix	CPqD	Luxtera	TELUS Communications, Inc.	Deutsche Telekom	M/A-COM Technology Solutions	TeraXion	Dove Networking Solutions	Mellanox Technologies	Texas Instruments	EMC Corp	Microsemi Inc.	Time Warner Cable	Emcore	Microsoft Corporation	US Conec	Ericsson	Mitsubishi Electric Corporation	Verizon	ETRI	Molex	Xilinx	FCI USA LLC	MoSys, Inc.	Yamaichi Electronics Ltd.	Fiberhome Technologies Group	MultiPhy Ltd	ZTE Corporation	Finisar Corporation	NEC	
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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<p>By way of example and without any limitation, Fujitsu's Flashwave 9500 Series products and 1Finity products comprise a transceiver card for a telecommunications box for transmitting data over a first optical fiber and receiving data over a second optical fiber. See, e.g., Exemplary Evidence of Infringement of Claim 14.</p>
	<p>[a] a transmitter for transmitting data over the first optical fiber, the transmitter having a laser, a modulator and a controller receiving input data and controlling the modulator as a function of the input data, the transmitter transmitting optical signals for telecommunication as a function of the input data;</p>	<p>The Accused Instrumentalities include a transmitter for transmitting data over the first optical fiber, the transmitter having a laser, a modulator, and a controller receiving input data and controlling the modulator as a function of the input data, the transmitter transmitting optical signals for telecommunication as a function of the input data.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transmitter module which includes a laser, modulators that modulate phase of the light, drivers, including other components that are not represented, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 5-6.</p> <p>Figure 4. Block diagram of a DP QPSK transmitter module</p>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>By way of example and without any limitation, the OIF 100G standard taught that the “signal [framed incoming data] then passes to the transceiver module. Data is converted to drive signals to control the optical modulators. A transmit laser provides the light source for the modulators. On the receive side the incoming signal is mixed with a local oscillator, demodulated into components, detected, amplified, digitized, then passed into the DSP module.” OIF-FD-100G-DWDM-01.0 at 9.</p> <p><u>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products and IFinity products comprise a transmitter for transmitting data over the first optical fiber, the transmitter having a laser, a modulator and a controller receiving input data and controlling the modulator as a function of the input data, the transmitter transmitting optical signals for telecommunication as a function of the input data. See, e.g., Exemplary Evidence of Infringement of Claim 14[a].</u></p>
	[b] a fiber output optically connected to the laser for connecting the first optical fiber to the card;	<p>The Accused Instrumentalities include a fiber output optically connected to the laser for connecting the first optical fiber to the card. By way of example and without any limitation, the Accused Instrumentalities include an optical fiber interface (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html); 100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/; 100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/; 100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/; 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/; 100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p>

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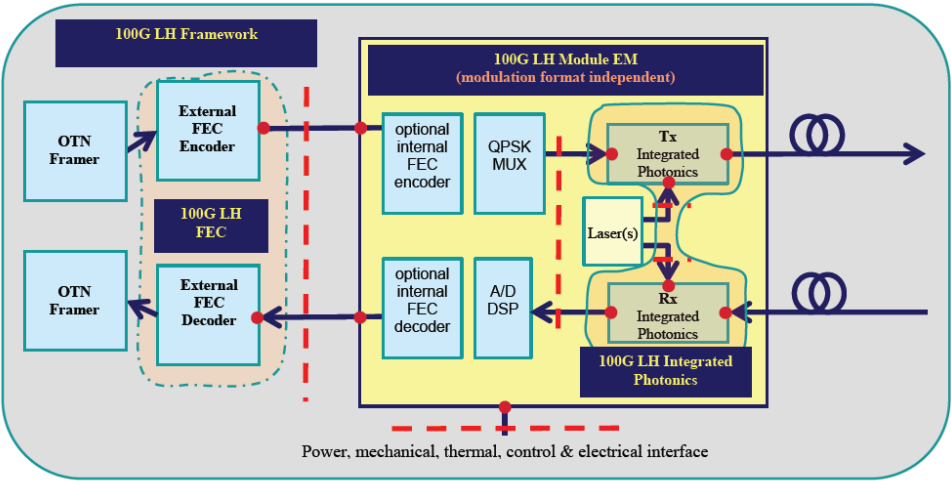
Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g; Flashwave CDS Data Sheet; Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module in which the optical signal is transmitted by Tx through a fiber output, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 9.</p> <p>Figure 7. Block diagram of a transceiver module</p> <p><u>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products and IFinity products comprise a fiber output optically connected to the laser for connecting the first</u></p>

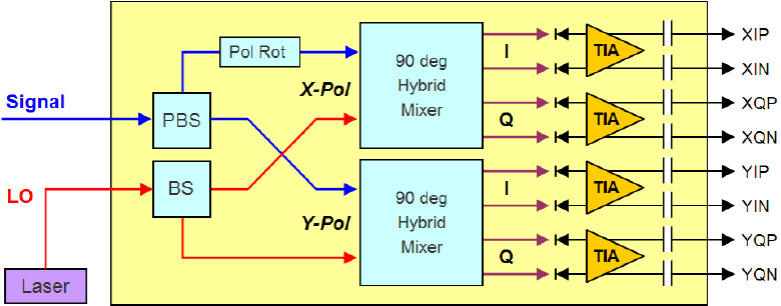
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<u>optical fiber to the card. See, e.g., Exemplary Evidence of Infringement of Claim 14[b].</u>
	[c] a fiber input for connecting the second optical fiber to the card;	<p>The Accused Instrumentalities include a fiber input for connecting the second optical fiber to the card. By way of example and without any limitation, the Accused Instrumentalities include an optical fiber interface (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html); 100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/; 100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/; 100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/; 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/; 100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g; 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g; Flashwave CDS Data Sheet; Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module in which the optical signal is received by Rx through a fiber input, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 9.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>Figure 7. Block diagram of a transceiver module</p><p>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products and IFinity products comprise a fiber input for connecting the second optical fiber to the card. See, e.g., Exemplary Evidence of Infringement of Claim 14[c].</p></div>
	[d] a receiver optically connected to the fiber input for receiving data from the second optical fiber; and	<p>The Accused Instrumentalities include a receiver optically connected to the fiber input for receiving data from the second optical fiber.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a receiver module which receives a phase modulated signal through an optical fiber, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

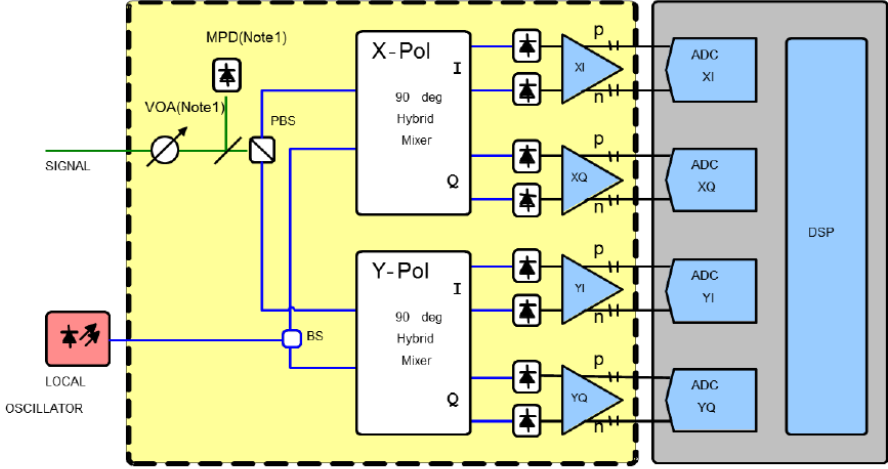
Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p> <p>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products and IFinity products comprise a receiver optically connected to the fiber input for receiving data from the second optical fiber. <i>See, e.g., Exemplary Evidence of Infringement of Claim 14[d].</i></p>
	[e] an energy level detector to measure an energy level of the optical signals, the energy level detector including a threshold indicating a drop in amplitude of a phase-modulated signal.	<p>The Accused Instrumentalities include an energy level detector to measure an energy level of the optical signals, and the energy level detector includes a threshold indicating a drop in amplitude of a phase-modulated signal. By way of example and without any limitation, an OIF 100G standard taught that devices should have “Alarm/Warning Threshold Registers,” including including registers for an Rx power low warning and low alarm. (OIF-CFP2-ACO-01.0, at 81)</p> <p>By way of example and without any limitation, the OIF 100G standard taught that:</p> <p>[a]s indicated in Figure 2-1, the coherent receiver requires the following basic functionality:</p> <ol style="list-style-type: none">1. Eight (8) photo-detectors, comprised of 4 sets of balanced detectors2. Four (4) linear amplifiers with differential ADC coupled outputs3. Two (2) ninety degree hybrid mixers with differential outputs

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>4. A polarization splitting element, separating the input signal into two orthogonal polarizations, with each polarization delivered to a hybrid mixer</p> <p>5. A polarization maintaining power splitter or polarization splitting element, splitting the local oscillator power equally to the two hybrid mixers.</p> <p>6. An optical power tap, and monitor photodiode in the signal input path before the signal polarization splitting element.</p> <p>7. A variable optical attenuator in the signal input path before the signal polarization splitting element.</p> <p>Additional required functionality for the integrated coherent receiver includes:</p> <ul style="list-style-type: none"> • Automatic Gain Control (AGC) and/or Manual Gain Control (MGC) • User settable output voltage swing • Independent output swing adjustment for each of the four outputs • Peak indicators for each output <p>(Figure 2-1 is presented below, showing the relationship of the functionalities in addition to the presence of ADC and DSP). OIF-DPC-MRX-01.0-IA at 10-11.</p>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<div><p>Figure 2-1: Functional diagram of a dual polarization micro intradyne coherent receiver.</p><p>Notes:</p><ol style="list-style-type: none">1. One configuration for the order of the VOA and MPD is shown. The configuration with the MPD followed by the VOA is an equally acceptable configuration.2. The yellow area enclosed by the dashed line indicates the functionality specified in this implementation agreement.<p><u>By way of example and without any limitation, Fujitsu's Flashwave 9500 Series products and IFinity products comprise an energy level detector to measure an energy level of the optical signals, the energy level detector including a threshold indicating a drop in amplitude of a phase-modulated signal. See, e.g., Exemplary Evidence of Infringement of Claim 14[e].</u></p></div>
27	The card as recited in claim 25 wherein the	The Accused Instrumentalities include a modulator that is a phase modulator. QPSK requires phase modulation. For example:

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
	modulator is a phase modulator.	<p>the Fujitsu 1100G OIF 168pin Coherent Transceiver (FIM85200) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html);</p> <p>the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP DCO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp-dco/);</p> <p>the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/);</p> <p>the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/);</p> <p>the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/);</p> <p>the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/);</p> <p>the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721) is a component of a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet);</p> <p>the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); and</p> <p>the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard stated a DP QPSK transmitter module which includes a laser, modulators that modulate phase of the light, drivers, including other components that are not represented, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 5-6.</p> <p style="text-align: center;">* Optional RZ Carver</p> <p style="text-align: center;">Figure 4. Block diagram of a DP QPSK transmitter module</p> <p><u>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products and IFinity products comprise the card as recited in claim 25 wherein the modulator is a phase</u></p>

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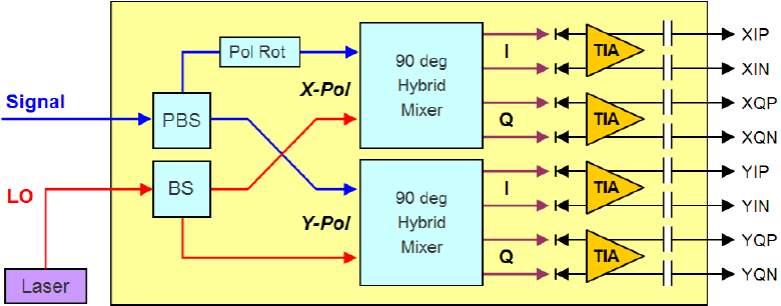
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<u>modulator. See, e.g., Exemplary Evidence of Infringement of Claim 3.</u>
28	The card as recited in claim 25 wherein the receiver receives phase-modulated signals.	<p>The Accused Instrumentalities include a receiver that receives phase-modulated signals. For example:</p> <p>the Fujitsu 1100G OIF 168pin Coherent Transceiver (FIM85200) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html);</p> <p>the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP DCO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp-dco/);</p> <p>the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/);</p> <p>the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/);</p> <p>the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/);</p> <p>the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/);</p> <p>the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p>

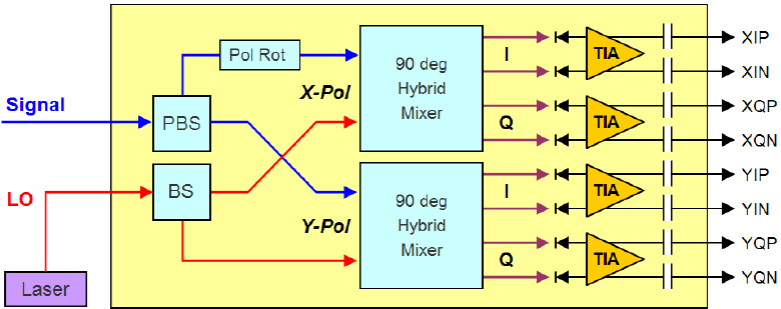
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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721) is a component of a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g); the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); and the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught that the “signal [framed incoming data] then passes to the transceiver module. Data is converted to drive signals to control the optical modulators. A transmit laser provides the light source for the modulators. On the receive side the incoming signal is mixed with a local oscillator, demodulated into components, detected, amplified, digitized, then passed into the DSP module.” OIF-FD-100G-DWDM-01.0 at 9.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a receiver module which receives a phase modulated signal through an optical fiber, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p> <p><u>By way of example and without any limitation, Fujitsu's Flashwave 9500 Series products and IFinity products comprise the card as recited in claim 25 wherein the receiver receives phase-modulated signals. See, e.g., Exemplary Evidence of Infringement of Claim 4.</u></p>
29	The card as recited in claim 25 wherein the energy level detector includes a photodiode and a liner or logarithmic amplifier scaling an output of the photodiode.	<p>On information and belief, the Accused Instrumentalities have an energy level detector that includes a photodiode and a linear or logarithmic amplifier scaling an output of the photodiode.</p> <p>By way of example and without any limitation, the OIF 100G standard stated that DP QPSK receiver module contains optical detectors and amplifiers, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

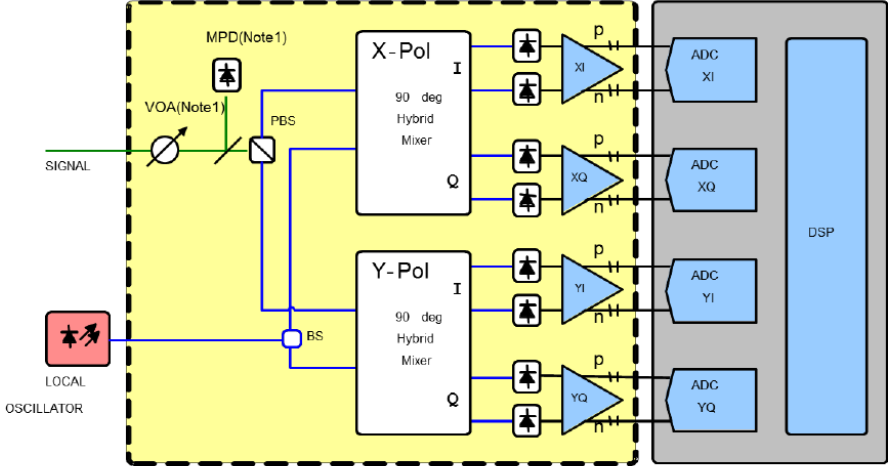
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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p> <hr/> <p>By way of example and without any limitation, an OIF 100G standard taught that As indicated in Figure 2-1, the coherent receiver requires the following basic functionality:</p> <ol style="list-style-type: none">1. Eight (8) photo-detectors, comprised of 4 sets of balanced detectors2. Four (4) linear amplifiers with differential ADC coupled outputs3. Two (2) ninety degree hybrid mixers with differential outputs4. A polarization splitting element, separating the input signal into two orthogonal polarizations, with each polarization delivered to a hybrid mixer5. A polarization maintaining power splitter or polarization splitting element, splitting the local oscillator power equally to the two hybrid mixers.6. An optical power tap, and monitor photodiode in the signal input path before the signal polarization splitting element.

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>7. A variable optical attenuator in the signal input path before the signal polarization splitting element.</p> <p>Additional required functionality for the integrated coherent receiver includes:</p> <ul style="list-style-type: none">• Automatic Gain Control (AGC) and/or Manual Gain Control (MGC)• User settable output voltage swing• Independent output swing adjustment for each of the four outputs• Peak indicators for each output <p>(Figure 2-1 is presented below, showing the relationship of the functionalities in addition to the presence of ADC and DSP). OIF-DPC-MRX-01.0-IA at 10-11.</p>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<div></div> <p>Figure 2-1: Functional diagram of a dual polarization micro intradyne coherent receiver.</p> <p>Notes:</p> <ol style="list-style-type: none">1. One configuration for the order of the VOA and MPD is shown. The configuration with the MPD followed by the VOA is an equally acceptable configuration.2. The yellow area enclosed by the dashed line indicates the functionality specified in this implementation agreement. <p><u>By way of example and without any limitation, Fujitsu's Flashwave 9500 Series products and IFinity products comprise the card as recited in claim 25 wherein the energy level detector includes a photodiode and a linear or logarithmic amplifier scaling an output of the photodiode. See, e.g., Exemplary Evidence of Infringement of Claim 5.</u></p>
33	The card as recited in claim 25 wherein the plurality of	On information and belief, the Accused Instrumentalities include threshold settings that bound an acceptable energy range for the received light.

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By way of example and without any limitation,

[7]

Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
	thresholds bound an acceptable energy range for the received light.	<p>By way of example and without any limitation, an OIF 100G standard taught that devices should have “Alarm/Warning Threshold Registers,” including an “RX Power Monitor Alarm/Warning Threshold Select.” (OIF-CFP2-ACO-01.0, at 81) The threshold settings bound an acceptable energy range for the received light in order to provide a meaningful indication of when the power is out of an acceptable range.</p> <p><u>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products and 1Finity products comprise the card as recited in claim 25 wherein the plurality of thresholds bound an acceptable energy range for the received light. See, e.g., Exemplary Evidence of Infringement of Claim 9.</u></p>
34	The card as recited in claim 25 wherein the energy level detector measures optical power.	<p>The Accused Instrumentalities include an energy level detector measures that optical power.</p> <p>By way of example and without any limitation, the OIF 100G standard taught the use of a monitoring photodiode that measures optical power. OIF-DPC-MRX-01.0-IA at 10-11.</p> <p><u>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products and 1Finity products comprise the card as recited in claim 25 wherein the energy level detector measures optical power. See, e.g., Exemplary Evidence of Infringement of Claim 12.</u></p>
36	[pre] A transceiver card for a telecommunications box for transmitting data over a first optical fiber and receiving data over a second optical fiber, the card comprising:	<p>Fujitsu infringed Claim 36, and the claims discussed herein that directly or indirectly depend on Claim 36, by making, selling, using, offering for sale, and/or causing to be used the Accused Instrumentalities.</p> <p>To the extent that the preamble is considered to be a limitation, the Accused Instrumentalities comprise transceiver card for a telecommunications box for transmitting data over a first optical fiber and receiving data over a second optical fiber.</p> <p>For example: the Fujitsu 1100G OIF 168pin Coherent Transceiver (FIM85200) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G OIF 168pin Coherent</p>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html);</p> <p>the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP DCO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp-dco/);</p> <p>the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/);</p> <p>the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/);</p> <p>the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/);</p> <p>the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/);</p> <p>the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721) is a component of a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p> <p>the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet);</p>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); and the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 8-9 (“All the blocks illustrated are contained on a single printed circuit board. The large block on the right represents the 100G transceiver module – electro mechanicals. As discussed above this OIF project addresses physical aspects of this module and the electrical data and control interfaces to it.”).</p> <p style="text-align: center;">Figure 7. Block diagram of a transceiver module</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement																																																																																							
		<p>By way of example and without any limitation, Fujitsu is a member of the OIF 100G standard. See, e.g., OIF-DPC-MRX-01.0-IA at 32.</p> <p>12 Appendix C: List of companies belonging to the OIF at approval date</p> <table> <tr><td>Acacia Communications</td><td>Fujikura</td><td>NeoPhotonics</td></tr> <tr><td>ADVA Optical Networking</td><td>Fujitsu</td><td>NTT Corporation</td></tr> <tr><td>Alcatel-Lucent</td><td>Furukawa Electric Japan</td><td>Oclaro</td></tr> <tr><td>Altera</td><td>Google</td><td>Orange</td></tr> <tr><td>AMCC</td><td>Hewlett Packard</td><td>PacketPhotonics</td></tr> <tr><td>Amphenol Corp.</td><td>Hitachi</td><td>PETRA</td></tr> <tr><td>Analog Devices</td><td>Huawei Technologies</td><td>Picometrix</td></tr> <tr><td>Anritsu</td><td>IBM Corporation</td><td>PMC Sierra</td></tr> <tr><td>Applied Communication Sciences</td><td>Infinera</td><td>QLogic Corporation</td></tr> <tr><td>Avago Technologies Inc.</td><td>Inphi</td><td>Qorvo</td></tr> <tr><td>Broadcom</td><td>Intel</td><td>Ranovus</td></tr> <tr><td>Brocade</td><td>Ixia</td><td>Rockley Photonics</td></tr> <tr><td>BRPhotonics</td><td>JDSU</td><td>Samtec Inc.</td></tr> <tr><td>BTI Systems</td><td>Juniper Networks</td><td>Semtech</td></tr> <tr><td>China Telecom</td><td>Kaiaam</td><td>Spirent Communications</td></tr> <tr><td>Ciena Corporation</td><td>Kandou</td><td>Sumitomo Electric Industries</td></tr> <tr><td>Cisco Systems</td><td>KDDI R&D Laboratories</td><td>Sumitomo Osaka Cement</td></tr> <tr><td>ClariPhy Communications</td><td>Keysight Technologies, Inc.</td><td>TE Connectivity</td></tr> <tr><td>Coriant R&G GmbH</td><td>LeCroy</td><td>Tektronix</td></tr> <tr><td>CPqD</td><td>Luxtera</td><td>TELUS Communications, Inc.</td></tr> <tr><td>Deutsche Telekom</td><td>M/A-COM Technology Solutions</td><td>TeraXion</td></tr> <tr><td>Dove Networking Solutions</td><td>Mellanox Technologies</td><td>Texas Instruments</td></tr> <tr><td>EMC Corp</td><td>Microsemi Inc.</td><td>Time Warner Cable</td></tr> <tr><td>Emcore</td><td>Microsoft Corporation</td><td>US Conec</td></tr> <tr><td>Ericsson</td><td>Mitsubishi Electric Corporation</td><td>Verizon</td></tr> <tr><td>ETRI</td><td>Molex</td><td>Xilinx</td></tr> <tr><td>FCI USA LLC</td><td>MoSys, Inc.</td><td>Yamaichi Electronics Ltd.</td></tr> <tr><td>Fiberhome Technologies Group</td><td>MultiPhy Ltd</td><td>ZTE Corporation</td></tr> <tr><td>Finisar Corporation</td><td>NEC</td><td></td></tr> </table>	Acacia Communications	Fujikura	NeoPhotonics	ADVA Optical Networking	Fujitsu	NTT Corporation	Alcatel-Lucent	Furukawa Electric Japan	Oclaro	Altera	Google	Orange	AMCC	Hewlett Packard	PacketPhotonics	Amphenol Corp.	Hitachi	PETRA	Analog Devices	Huawei Technologies	Picometrix	Anritsu	IBM Corporation	PMC Sierra	Applied Communication Sciences	Infinera	QLogic Corporation	Avago Technologies Inc.	Inphi	Qorvo	Broadcom	Intel	Ranovus	Brocade	Ixia	Rockley Photonics	BRPhotonics	JDSU	Samtec Inc.	BTI Systems	Juniper Networks	Semtech	China Telecom	Kaiaam	Spirent Communications	Ciena Corporation	Kandou	Sumitomo Electric Industries	Cisco Systems	KDDI R&D Laboratories	Sumitomo Osaka Cement	ClariPhy Communications	Keysight Technologies, Inc.	TE Connectivity	Coriant R&G GmbH	LeCroy	Tektronix	CPqD	Luxtera	TELUS Communications, Inc.	Deutsche Telekom	M/A-COM Technology Solutions	TeraXion	Dove Networking Solutions	Mellanox Technologies	Texas Instruments	EMC Corp	Microsemi Inc.	Time Warner Cable	Emcore	Microsoft Corporation	US Conec	Ericsson	Mitsubishi Electric Corporation	Verizon	ETRI	Molex	Xilinx	FCI USA LLC	MoSys, Inc.	Yamaichi Electronics Ltd.	Fiberhome Technologies Group	MultiPhy Ltd	ZTE Corporation	Finisar Corporation	NEC	
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12 Appendix C: List of companies belonging to the OIF at approval date

Acacia Communications	Fujikura
ADVA Optical Networking	Fujitsu
Alcatel-Lucent	Furukawa Electric Japan
Altera	Google
AMCC	Hewlett Packard
Amphenol Corp.	Hitachi
Analog Devices	Huawei Technologies
Anritsu	IBM Corporation
Applied Communication Sciences	Infinera
Avago Technologies Inc.	Inphi
Broadcom	Intel
Brocade	Ixia
BRPhotonics	JDSU
BTI Systems	Juniper Networks
China Telecom	Kaiaam
Ciena Corporation	Kandou
Cisco Systems	KDDI R&D Laboratories
ClariPhy Communications	Keysight Technologies, Inc.
Coriant R&G GmbH	LeCroy
CPqD	Luxtera
Deutsche Telekom	M/A-COM Technology Solutions
Dove Networking Solutions	Mellanox Technologies
EMC Corp	Microsemi Inc.
Emcore	Microsoft Corporation
Ericsson	Mitsubishi Electric Corporation
ETRI	Molex
FCI USA LLC	MoSys, Inc.
Fiberhome Technologies Group	MultiPhy Ltd
Finisar Corporation	NEC

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<p>By way of example and without any limitation, Fujitsu's Flashwave 9500 Series products and 1Finity products comprise a transceiver card for a telecommunications box for transmitting data over a first optical fiber and receiving data over a second optical fiber. See, e.g., Exemplary Evidence of Infringement of Claim 14.</p>
	<p>[a] a transmitter for transmitting data over the first optical fiber, the transmitter having a laser, a modulator and a controller receiving input data and controlling the modulator as a function of the input data, the transmitter transmitting optical signals for telecommunication as a function of the input data;</p>	<p>The Accused Instrumentalities include a transmitter for transmitting data over the first optical fiber, the transmitter having a laser, a modulator, and a controller receiving input data and controlling the modulator as a function of the input data, the transmitter transmitting optical signals for telecommunication as a function of the input data.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transmitter module which includes a laser, modulators that modulate phase of the light, drivers, including other components that are not represented, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 5-6.</p> <p>* Optional RZ Carver</p> <p>Figure 4. Block diagram of a DP QPSK transmitter module</p>

Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>By way of example and without any limitation, the OIF 100G standard taught that the “signal [framed incoming data] then passes to the transceiver module. Data is converted to drive signals to control the optical modulators. A transmit laser provides the light source for the modulators. On the receive side the incoming signal is mixed with a local oscillator, demodulated into components, detected, amplified, digitized, then passed into the DSP module.” OIF-FD-100G-DWDM-01.0 at 9.</p> <p><u>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products and IFinity products comprise a transmitter for transmitting data over the first optical fiber, the transmitter having a laser, a modulator and a controller receiving input data and controlling the modulator as a function of the input data, the transmitter transmitting optical signals for telecommunication as a function of the input data. See, e.g., Exemplary Evidence of Infringement of Claim 14[a].</u></p>
	[b] a fiber output optically connected to the laser for connecting the first optical fiber to the card;	<p>The Accused Instrumentalities include a fiber output optically connected to the laser for connecting the first optical fiber to the card. By way of example and without any limitation, the Accused Instrumentalities include an optical fiber interface (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html); 100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/; 100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/; 100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/; 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/; 100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g);</p>

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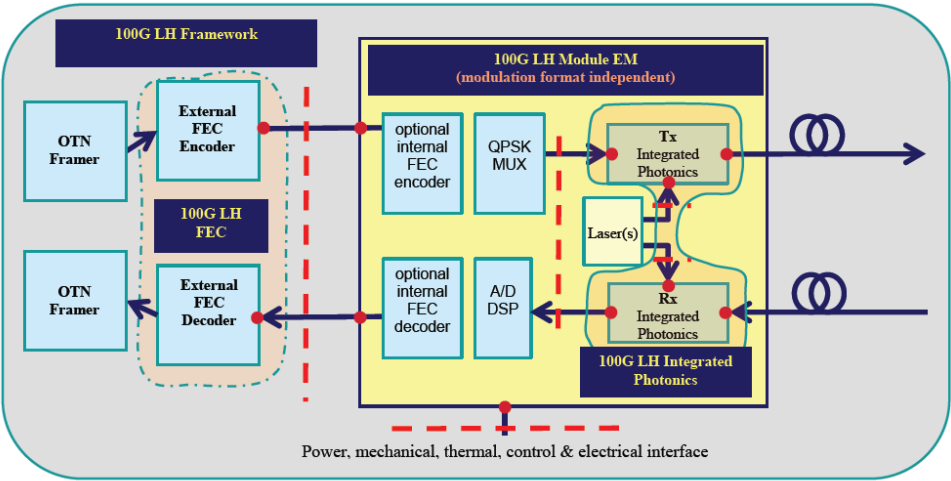
Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g; Flashwave CDS Data Sheet; Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module in which the optical signal is transmitted by Tx through a fiber output, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 9.</p> <p style="text-align: center;">Figure 7. Block diagram of a transceiver module</p> <p><u>By way of example and without any limitation, Fujitsu’s Flashwave 9500 Series products and IFinity products comprise a fiber output optically connected to the laser for connecting the first optical fiber to the card. See, e.g., Exemplary Evidence of Infringement of Claim 14[b].</u></p>

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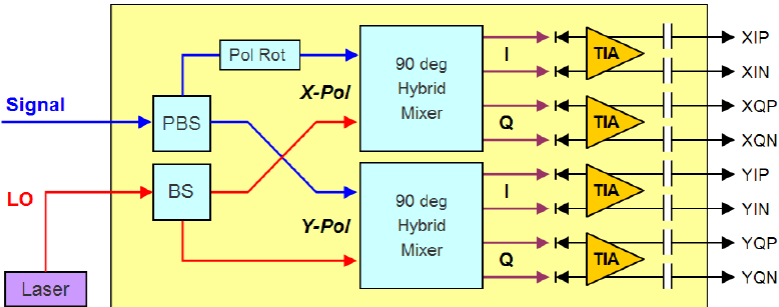
Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
	[c] a fiber input for connecting the second optical fiber to the card;	<p>The Accused Instrumentalities include a fiber input for connecting the second optical fiber to the card. By way of example and without any limitation, the Accused Instrumentalities include an optical fiber interface (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html); 100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/; 100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/; 100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/; 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/; 100G Optical Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g; 100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g; Flashwave CDS Data Sheet; Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard taught a transceiver module in which the optical signal is received by Rx through a fiber input, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 9.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>Figure 7. Block diagram of a transceiver module</p><p>By way of example and without any limitation, Fujitsu's Flashwave 9500 Series products and IFinity products comprise a fiber input for connecting the second optical fiber to the card. See, e.g., Exemplary Evidence of Infringement of Claim 14[c].</p></div>
	[d] a receiver optically connected to the fiber input for receiving data from the second optical fiber;	<p>The Accused Instrumentalities include a receiver optically connected to the fiber input for receiving data from the second optical fiber.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a receiver module which receives a phase modulated signal through an optical fiber, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

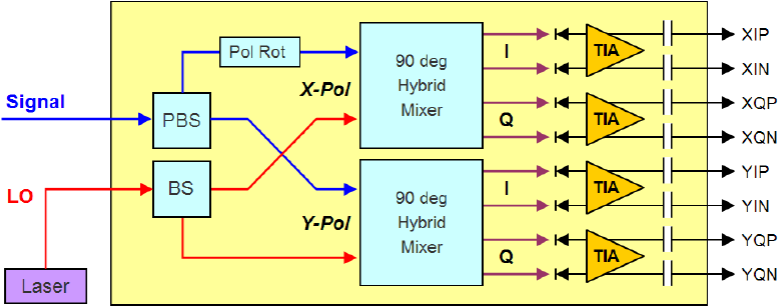
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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p> <p>By way of example and without any limitation, Fujitsu's Flashwave 9500 Series products and IFinity products comprise a receiver optically connected to the fiber input for receiving data from the second optical fiber. <i>See, e.g., Exemplary Evidence of Infringement of Claim 14[d].</i></p>
	[e] a splitter to split at least a portion of the optical signals to form a split optical signal,	<p>The Accused Instrumentalities include a splitter to split at least a portion of the optical signals to form a split optical signal.</p> <p>By way of example and without any limitation, the OIF 100G standard depicted the use splitters to split the optical signal and the local oscillator, as presented below. <i>See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</i></p>

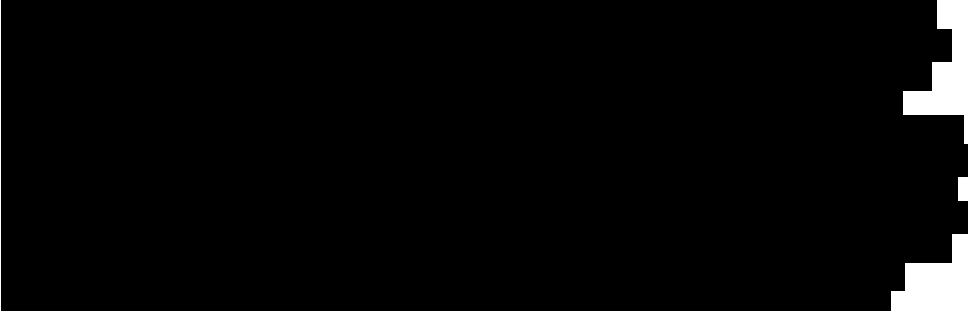
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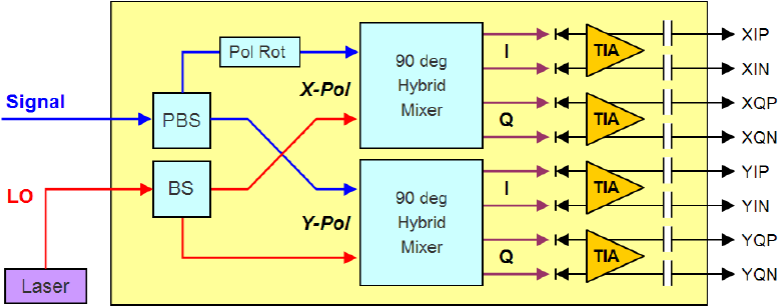
Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p><div></div></div>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
	[f] a photodetector to measure the split optical signal, the photodetector outputting an electric voltage to correlating to an optical power of the split optical signal, and	<p>The Accused Instrumentalities include a photodetector to measure the split optical signal, the photodetector outputting an electric voltage to correlating to an optical power of the split optical signal.</p> 
	[g] a detector controller connected electrically to the photodetector.	<p>The Accused Instrumentalities include a detector controller connected electrically to the photodetector.</p> <p>By way of example and without any limitation, the OIF 100G standard taught a receiver module with a number of optical components that form a demodulator, followed by optical detectors and transimpedance amplifiers, as shown below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p> <hr/> <p>By way of example and without any limitation, an OIF 100G standard taught that As indicated in Figure 2-1, the coherent receiver requires the following basic functionality:</p> <ol style="list-style-type: none">1. Eight (8) photo-detectors, comprised of 4 sets of balanced detectors2. Four (4) linear amplifiers with differential ADC coupled outputs3. Two (2) ninety degree hybrid mixers with differential outputs4. A polarization splitting element, separating the input signal into two orthogonal polarizations, with each polarization delivered to a hybrid mixer5. A polarization maintaining power splitter or polarization splitting element, splitting the local oscillator power equally to the two hybrid mixers.6. An optical power tap, and monitor photodiode in the signal input path before the signal polarization splitting element.


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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>7. A variable optical attenuator in the signal input path before the signal polarization splitting element.</p> <p>Additional required functionality for the integrated coherent receiver includes:</p> <ul style="list-style-type: none">• Automatic Gain Control (AGC) and/or Manual Gain Control (MGC)• User settable output voltage swing• Independent output swing adjustment for each of the four outputs• Peak indicators for each output <p>(Figure 2-1 is presented below, showing the relationship of the functionalities in addition to the presence of ADC and DSP). OIF-DPC-MRX-01.0-IA at 10-11.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 2-1: Functional diagram of a dual polarization micro intradyne coherent receiver.</p> <p>Notes:</p> <ol style="list-style-type: none">1. One configuration for the order of the VOA and MPD is shown. The configuration with the MPD followed by the VOA is an equally acceptable configuration.2. The yellow area enclosed by the dashed line indicates the functionality specified in this implementation agreement. <div></div>

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		
37	The card as recited in claim 36 wherein the modulator is a phase modulator.	<p>The Accused Instrumentalities include a modulator that is a phase modulator. QPSK requires phase modulation. For example, the Fujitsu 1100G OIF 168pin Coherent Transceiver (FIM85200) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G OIF 168pin Coherent Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gtrx/index.html); the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP DCO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp-dco/); the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) is a transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/200G CFP2 ACO Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/cfp2-aco/); the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37102) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/); the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp2/); the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100g-qsfp28/); the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FTM7977HQA) is a transceiver card with a transmitting and receiving interface for DP-QPSK data (100G Optical</p>

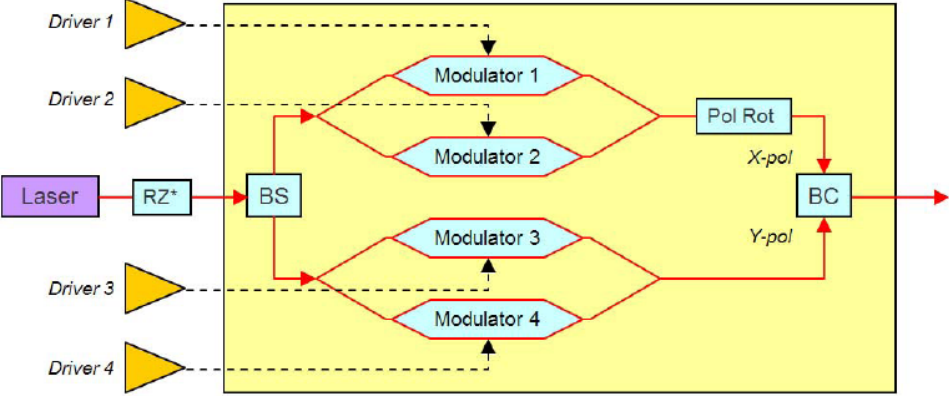
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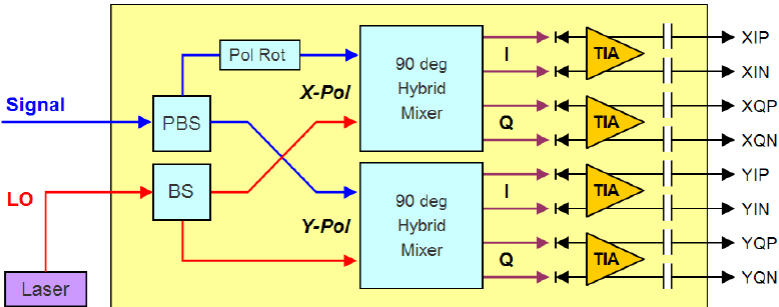
Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>Devices Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g); the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24721) is a component of a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#ln-100g); the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); and the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting and receiving interface for DP-QPSK data (Flashwave 7420 Data Sheet)</p> <p>By way of example and without any limitation, the OIF 100G standard stated a DP QPSK transmitter module which includes a laser, modulators that modulate phase of the light, drivers, including other components that are not represented, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 5-6.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div><p>Figure 4. Block diagram of a DP QPSK transmitter module</p><p>By way of example and without any limitation, Fujitsu's Flashwave 9500 Series products and IFinity products comprise a receiver optically connected to the fiber input for receiving data from the second optical fiber. See, e.g., Exemplary Evidence of Infringement of Claim 3.</p></div>
38	The card as recited in claim 36 further comprising a photodiode and a liner or logarithmic amplifier scaling an output of the photodiode.	<p>On information and belief, the Accused Instrumentalities have an energy level detector that includes a photodiode and a linear or logarithmic amplifier scaling an output of the photodiode.</p> <p>By way of example and without any limitation, the OIF 100G standard stated that DP QPSK receiver module contains optical detectors and amplifiers, as depicted below. See, e.g., OIF-FD-100G-DWDM-01.0 at 6.</p>

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Asserted Claim No.	Claim Element	Exemplary Evidence of Infringement
		<div></div> <p>Figure 5. Block diagram of a DP QPSK receiver module, shown with balanced detection and outputs.</p> <hr/> <p>By way of example and without any limitation, an OIF 100G standard taught that As indicated in Figure 2-1, the coherent receiver requires the following basic functionality:</p> <ol style="list-style-type: none">1. Eight (8) photo-detectors, comprised of 4 sets of balanced detectors2. Four (4) linear amplifiers with differential ADC coupled outputs3. Two (2) ninety degree hybrid mixers with differential outputs4. A polarization splitting element, separating the input signal into two orthogonal polarizations, with each polarization delivered to a hybrid mixer5. A polarization maintaining power splitter or polarization splitting element, splitting the local oscillator power equally to the two hybrid mixers.6. An optical power tap, and monitor photodiode in the signal input path before the signal polarization splitting element.

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Asserted Claim No.	Claim Element	<u>Exemplary Evidence of Infringement</u>
		<p>7. A variable optical attenuator in the signal input path before the signal polarization splitting element.</p> <p>Additional required functionality for the integrated coherent receiver includes:</p> <ul style="list-style-type: none">• Automatic Gain Control (AGC) and/or Manual Gain Control (MGC)• User settable output voltage swing• Independent output swing adjustment for each of the four outputs• Peak indicators for each output <p>(Figure 2-1 is presented below, showing the relationship of the functionalities in addition to the presence of ADC and DSP). OIF-DPC-MRX-01.0-IA at 10-11.</p>

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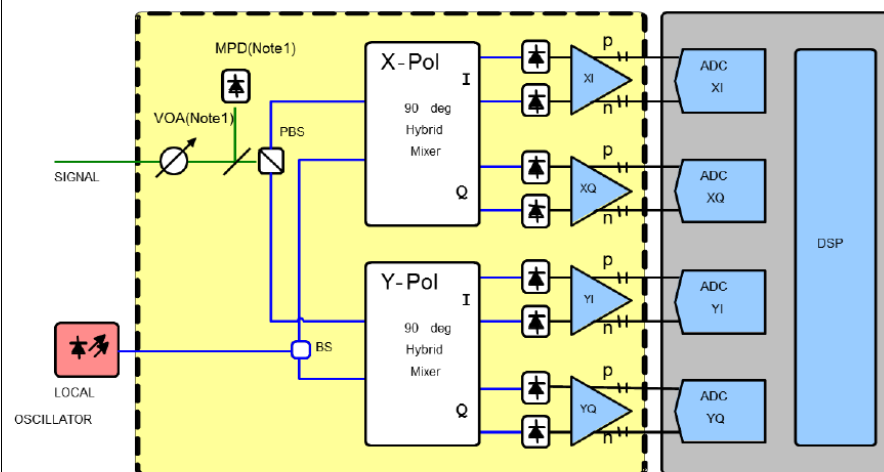


Figure 2-1: Functional diagram of a dual polarization micro intradyne coherent receiver.

Notes:

1. One configuration for the order of the VOA and MPD is shown. The configuration with the MPD followed by the VOA is an equally acceptable configuration.
2. The yellow area enclosed by the dashed line indicates the functionality specified in this implementation agreement.

By way of example and without any limitation, Fujitsu's Flashwave 9500 Series products and IFinity products comprise the card as recited in claim 36 further comprising a photodiode and a linear or logarithmic amplifier scaling an output of the photodiode. See, e.g., Exemplary Evidence of Infringement of Claim 5.

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6	The card as recited in claim 1 wherein the thresholds are programmable.	On information and belief, the Accused Instrumentalities include program the energy level detector. By way of example and without any limitation, an OIF 100G standard tai have "Alarm/Warning Threshold Registers," including an "RX Power M Threshold Select." (OIF-CFP2-ACO-01.0, at 81)	
7	The card as recited in claim 1 wherein the energy level detector includes a detector controller capable of setting values for the thresholds.	On information and belief, the Accused Instrumentalities include a detect setting values for the thresholds. By way of example and without any limitation, an OIF 100G standard tai have "Alarm/Warning Threshold Registers," including an "RX Power M Threshold Select." (OIF-CFP2-ACO-01.0, at 81) On information and bel controller sets values for the thresholds.	
8	The card as recited in claim 7 wherein the detector controller receives an indication of a threshold being crossed.	On information and belief, the Accused Instrumentalities include a detect receives an indication of a threshold being crossed. By way of example and without any limitation, an OIF 100G standard tai have "Alarm/Warning Threshold Registers," including registers for Rx p warnings, and low and high alarms. (OIF-CFP2-ACO-01.0, at 81)	
9	The card as recited in claim 1 wherein the plurality of thresholds bound an acceptable energy range for the received light.	On information and belief, the Accused Instrumentalities include thresho an acceptable energy range for the received light. By way of example and without any limitation, an OIF 100G standard tai have "Alarm/Warning Threshold Registers," including an "RX Power M Threshold Select." (OIF-CFP2-ACO-01.0, at 81) The threshold settings t energy range for the received light in order to provide a meaningful indic power is out of an acceptable range.	
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12	The card as recited in claim 1 wherein the energy level detector measures optical power.	The Accused Instrumentalities include an energy level detector measures By way of example and without any limitation, the OIF 100G standard tai monitoring photodiode that measures optical power. OIF-DPC-MRX-01	

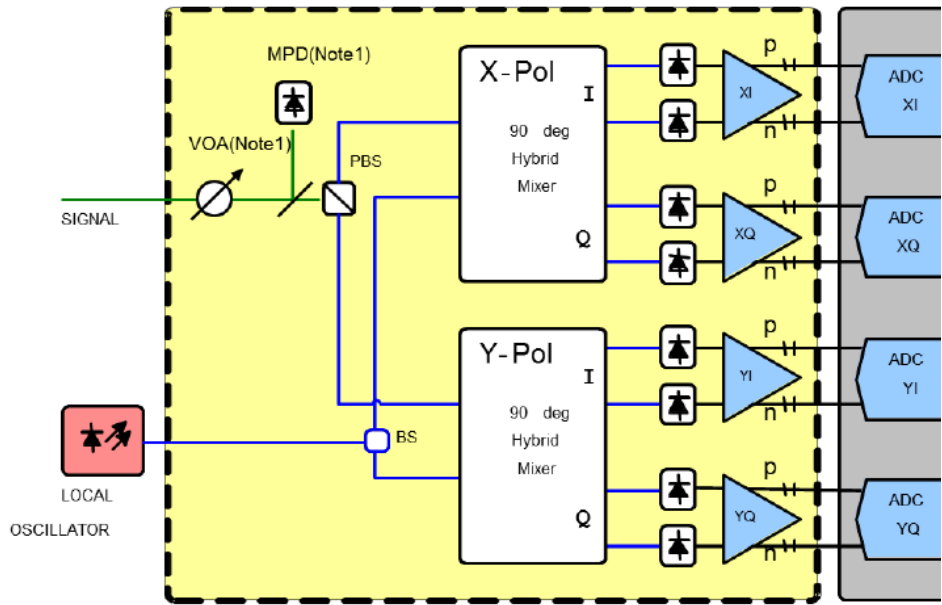


Figure 2-1: Functional diagram of a dual polarization micro intrady

Notes:

1. One configuration for the order of the VOA and MPD is shown. The configuration followed by the VOA is an equally acceptable configuration.
2. The yellow area enclosed by the dashed line indicates the functionality implementation agreement.

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19	The card as recited in claim 14 wherein the threshold is programmable.	On information and belief, the Accused Instrumentalities include program the energy level detector. By way of example and without any limitation, an OIF 100G standard may have "Alarm/Warning Threshold Registers," including an "RX Power Monitor Threshold Select." (OIF-CFP2-ACO-01.0, at 81)
20	The card as recited in claim 14 wherein the energy level detector includes a detector controller capable of setting a value for the threshold.	On information and belief, the Accused Instrumentalities include a detector setting values for the thresholds. By way of example and without any limitation, an OIF 100G standard may have "Alarm/Warning Threshold Registers," including an "RX Power Monitor Threshold Select." (OIF-CFP2-ACO-01.0, at 81) On information and belief, the detector controller sets values for the thresholds.
21	The card as recited in claim 20 wherein the detector controller	On information and belief, the Accused Instrumentalities include a detector that receives an indication of a threshold being crossed.

	receives an indication of the threshold being crossed.	By way of example and without any limitation, an OIF 100G standard tail have "Alarm/Warning Threshold Registers," including registers for Rx power warnings, and low and high alarms. (OIF-CFP2-ACO-01.0, at 81)
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23	The card as recited in claim 14 wherein the energy level detector measures optical power.	<p>the Accused Instrumentalities include an energy level detector measures the</p> <p>By way of example and without any limitation, the OIF 100G standard tail monitoring photodiode that measures optical power. OIF-DPC-MRX-01</p>
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26	The card as recited in claim 25 wherein the energy level detector includes an OR gate.	
27	The card as recited in claim 25 wherein the modulator is a phase modulator.	<p>The Accused Instrumentalities include a modulator that is a phase modulation. For example:</p> <p>the Fujitsu 1100G OIF 168pin Coherent Transceiver (FIM85200) is a transmitting and receiving interface for DP-QPSK data. (100G OIF 168p Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/modules/100gtrx/index.html);</p> <p>the Fujitsu 100G CFP DCO Transceiver (FIM38000/100; FIM38100/100) with a transmitting and receiving interface for DP-QPSK data. (100G CFP Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gcfp/);</p> <p>the Fujitsu 100G/200G CFP2 ACO Transceiver (FIM38500; FIM38100) with a transmitting and receiving interface for DP-QPSK data. (100G/200G Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/modules/cfp2-aco/);</p> <p>the Fujitsu 100G CFP Transceiver (FIM37101; FIM37102; FIM37201; FIM37202) transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/modules/100gcfp/);</p> <p>the Fujitsu 100G CFP2 Transceiver (FIM37301; FIM37302; FIM37401; FIM37402) transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G CFP2 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/modules/100gcfp2/);</p> <p>the Fujitsu 100G QSFP28 Transceiver (FIM37700; FIM37800) is a transmitting and receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-modules/100gqsfp28/);</p> <p>the Fujitsu 100G/400G LN Modulator (FTM7992HM; FTM7990HKA; FIM7990HKA) transceiver card with a transmitting and receiving interface for DP-QPSK data. (100G/400G LN Modulator Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/100gln/);</p> <p>the Fujitsu 100G/400G Integrated Coherent Receiver (FIM24901; FIM24902) is a transceiver with receiving interface for DP-QPSK data (100G QSFP28 Transceiver Product Page, http://www.fujitsu.com/jp/group/foc/en/products/optical-devices/#);</p>

the Fujitsu HD62 OTN Switch Aggregator Unit is a transceiver card with receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); the Fujitsu TM61 OTU4 OTN Transponder Demarcation Unit is a transceiver card with transmitting and receiving interface for DP-QPSK data (Flashwave CDS Data Sheet); the Fujitsu Flashwave 7420 WDM Platform a transceiver card with a transmitting interface for DP-QPSK data (Flashwave 7420 Data Sheet)

By way of example and without any limitation, the OIF 100G standard specifies a transmitter module which includes a laser, modulators that modulate phase and amplitude, including other components that are not represented, as depicted below. See OIF 100G-DWDM-01.0 at 5-6.

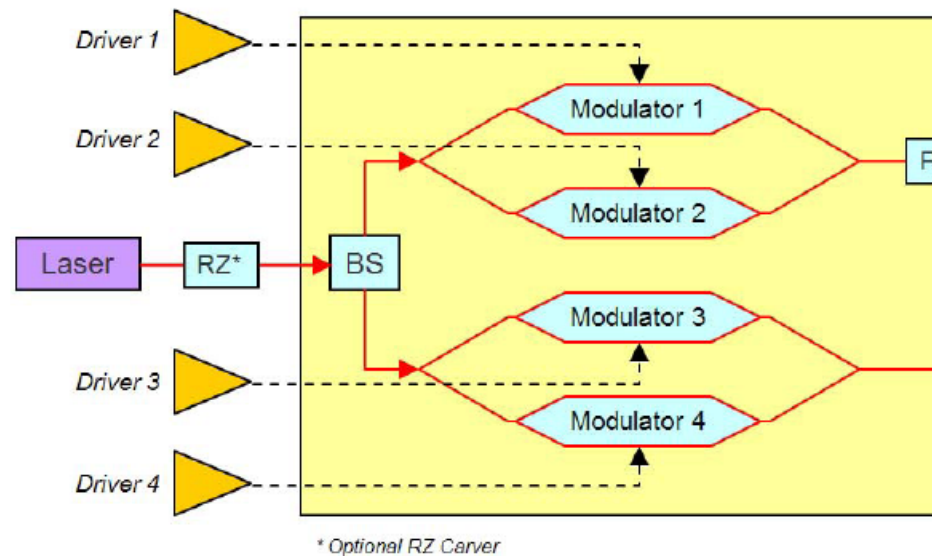


Figure 4. Block diagram of a DP QPSK transmitter

By way of example and without any limitation, Fujitsu's Flashwave 9500 100G DWDM products comprise the card as recited in claim 25 wherein the module includes a modulator. See, e.g., Exemplary Evidence of Infringement of Claim 3.

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30	The card as recited in claim 25 wherein the threshold is programmable.	On information and belief, the Accused Instrumentalities include programming the energy level detector. By way of example and without any limitation, an OIF 100G standard transmitter has "Alarm/Warning Threshold Registers," including an "RX Power Monitor Threshold Select." (OIF-CFP2-ACO-01.0, at 81)
31	The card as recited in claim 25 wherein the energy level detector includes a detector controller capable of	On information and belief, the Accused Instrumentalities include a detector setting values for the thresholds. By way of example and without any limitation, an OIF 100G standard transmitter has "Alarm/Warning Threshold Registers," including an "RX Power Monitor Threshold Select." (OIF-CFP2-ACO-01.0, at 81) On information and belief,

	setting a value for the threshold.	controller sets values for the thresholds.
32	The card as recited in claim 25 wherein the detector controller receives an indication of the threshold being crossed.	<p>On information and belief, the Accused Instrumentalities include a detector receives an indication of a threshold being crossed.</p> <p>By way of example and without any limitation, an OIF 100G standard tar have “Alarm/Warning Threshold Registers,” including registers for Rx p warnings, and low and high alarms. (OIF-CFP2-ACO-01.0, at 81)</p>

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